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Sellier (R.). **Les insectes utiles. Biologie des insectes auxiliaires—utilisation des insectes par l'homme.**—286 pp., 75 figs., 6 pp. refs. Paris, Payot, 1959. Price *N.Fr.* 18.

This book was written to emphasise that insects include beneficial species as well as pests. The groups considered comprise pollinating insects, scavengers of various sorts, entomophagous insects (with special chapters on parasites and predators of agricultural pests and the ways in which they have been used for purposes of biological control), insects that destroy weeds, insects of commercial importance (*Bombyx mori* (L.), other silk-producing Lepidoptera and honey bees), and miscellaneous insects that are of use in various ways, such as for food, decorative purposes or laboratory tests. A final section is concerned with the problem of the protection of beneficial insects.

Duffy (E. A. J.). **A monograph of the immature stages of Neotropical timber beetles (Cerambycidae).**—10 × 7¼ in., [7+] 327 pp., frontis., 13 pls., 176 figs., 20 pp. refs. London, Brit. Mus. (Nat. Hist.), 1960. Price £6 6*s*.

This monograph, which is the third of a proposed series on the Longicorn timber beetles of the world [*cf. R.A.E.*, A **41** 299; **45** 373], is devoted to those of the Neotropical region, comprising the greater part of Mexico, Central America, the Caribbean and the whole of the South American continent, and includes some that also occur in North America and some Nearctic species of which the range extends into Mexico. In scope and general arrangement, it resembles the previous one. Keys are given for the separation of the larvae of 123 genera and 160 species and pupae of 67 genera and 78 species, and some 420 species are dealt with in the text and a short appendix. Information on the immature stages and bionomics of Neotropical Longicorns has hitherto been in general scanty and scattered throughout the literature; the great majority of the larvae and pupae dealt with in the present work are described for the first time, and much of the information on their bionomics is based on the author's observations in the field in British Guiana and Trinidad.

Fisher (R.) & Rosner (L.). **Toxicology of the microbial insecticide, Thuricide.**—*J. agric. Fd Chem.* **7** no. 10 pp. 686–688, 10 refs. Easton, Pa., 1959.

Thuricide is a proprietary preparation of the spores of *Bacillus thuringiensis* authorised in the United States for the control of insects on food and forage crops. Its safety in use [*cf. R.A.E.*, A **48** 388] was demonstrated in tests described in this paper, in which a sample containing 9×10^9 viable spores per g. was administered in various ways to laboratory animals without harm, though the diatomaceous-earth carrier sometimes had an unfavourable effect, and another containing 3×10^9 viable spores per g. was ingested in capsules at the rate of 1 g. Thuricide per day for five days by human volunteers, some of whom also inhaled 100 mg. of the powder daily for the same period, with no ill effects. Workers engaged in manufacturing the powder remained healthy, and the field application of nearly 1,000 lb. Thuricide in 1957 and 1958 resulted in no reports of toxicity to plants, animals, humans or beneficial insects.

Bowery (T. G.), Evans (W. R.), Guthrie (F. E.) & Rabb (R. L.). **Insecticide residues on tobacco.**—*J. agric. Fd Chem.* **7** no. 10 pp. 693–702, 1 graph, 24 refs. Easton, Pa., 1959.

In view of a lack of information as to the magnitude and fate of insecticide residues on tobacco, analyses of commercial samples of tobacco that had been sprayed or dusted in the field with DDD (TDE) or endrin were made. The following is based on the authors' summary of the results. DDD and endrin residues on green tobacco during priming time exceeded 50 and 10 parts per million, respectively. About 45 per cent. of these residues were dissipated during processing. Auction-market tobacco contained about 37 p.p.m. DDD and 1·8 p.p.m. endrin, and averages of 13 μg. DDD and 0·2 μg. endrin were found per commercial cigarette. DDD and dehydrochlorinated DDD (1,1-di(p-chlorophenyl)-2-chloroethylene) were measured in the mainstream smoke of commercial cigarettes and found to amount to 1·6 and 1·4 μg. per "smoked cigarette." This information suggests that further education is needed in the application of these insecticides to minimise residues. Studies on newer insecticides should be made with a view to producing flue-cured tobacco yielding insecticide-free cigarette smoke.

Gyrisco (G. G.) & others. **Effects of feeding low levels of insecticide residues on hay to dairy cattle on flavor and residues in milk.**—*J. agric. Fd Chem.* **7** no. 10 pp. 707–711, 23 refs. Easton, Pa., 1959.

The following is based on the authors' summary. In tests in 1950–52, hay bearing residues of up to 10 parts aldrin, lindane [almost pure γ BHC], parathion or methoxy-DDT (methoxychlor) per million was fed to dairy cows for periods of up to three months. No parathion or methoxy-DDT was found in any of the milk samples. No γ BHC was found in the milk in the 1950–51 experiments, but in 1951–52 the mean γ BHC residue content for all sampling dates was significantly greater than that of the check. However, the γ BHC present at any single sampling date was not significantly different from the check. Small but significant amounts of DDT and aldrin were present in the milk when cows were fed 10 p.p.m. of each for one month. At 2 to 4 p.p.m., no aldrin was detected and no effect was noted on the cows' well-being or the vital organs of the slaughtered cows. There were no off-flavours or odours attributable to feeding on any of the insecticides.

Gannon (N.), Link (R. P.) & Decker (G. C.). **Storage of dieldrin in tissues and its excretion in milk of dairy cows fed dieldrin in their diets.**—*J. agric. Fd Chem.* **7** no. 12 pp. 824–826, 1 graph, 7 refs. Easton, Pa., 1959. **Storage of dieldrin in tissues of steers, hogs, lambs, and poultry fed dieldrin in their diets.**—*T.c.* pp. 826–828, 1 graph, 6 refs. **Insecticide residues in the milk of dairy cows fed insecticides in their daily ration.**—*T.c.* pp. 829–832, 2 graphs, 9 refs.

The following paragraphs are based on the authors' summaries of these three papers, respectively.

Dieldrin, ingested by dairy cows in their diet at rates of 0·1, 0·25, 0·75 and 2·25 parts per million, appeared in their milk at the end of 6–12 weeks at average levels of 0·02, 0·06, 0·11 and 0·28 p.p.m., respectively. Tissue analyses at the end of the feeding period indicated that dieldrin was present in fats at concentrations varying from 0·24 p.p.m. at the lowest level of

feeding to 5·48 at the highest. The amounts of dieldrin found in other tissues were proportionate to their fat content.

Dieldrin was ingested in their diet by steers, hogs and lambs for 12 weeks at rates of 0·1, 0·25, 0·75 and 2·25 parts per million and by fowls at the first three rates. Analysis of tissue samples at the end of the period showed that dieldrin was detectable in the fat of all the animals, the amount stored being proportional to the intake. Laying hens stored the greatest quantity of all, but their eggs contained little dieldrin. Hogs stored less than steers and more than lambs.

Aldrin, dieldrin, heptachlor, DDT and methoxy-DDT (methoxychlor) were ingested at various rates in their daily ration by dairy cows for 16 weeks, after which the animals received insecticide-free food. Milk samples were analysed during both periods, and it was found the rate of accumulation was greatest for aldrin (excreted as dieldrin), followed in order by dieldrin, DDT, heptachlor (excreted as heptachlor epoxide) and methoxy-DDT.

Moorefield (H. H.). **Synergism of the carbamate insecticides.**—*Contr. Boyce Thompson Inst.* **19** no. 6 pp. 501–507, 1 graph, 12 refs. Yonkers, N.Y., 1958.

When two aromatic carbamates, 3-tert.-butylphenyl N-methylcarbamate and Sevin, and two heterocyclic carbamates, Pyrolan and Isolan, were applied topically to adult females of *Musca domestica* L., alone and with four methylenedioxyphenyl synergists, piperonyl butoxide, sesamex (Sesoxane), sulfoxide, propyl isome and a commercial preparation of sesame-oil extractives, in insecticide : synergist ratios varying from 1 : 1 to 1 : 20, the additions increased toxicity, especially over the range 1 : 5–1 : 10. The first two carbamates, which gave kills of only about 70–80 per cent. at doses of 10–40 μg. per fly, caused complete or almost complete mortality in 18 hours at 1 μg. or less when combined 1 : 5 with piperonyl butoxide, and Sevin at 0·2 μg. and piperonyl butoxide at 2 μg., though each alone completely non-toxic, together gave complete kill. Isolan and Pyrolan alone gave almost complete mortality at doses of less than 10 μg. per fly, but were about ten times as effective with the addition of piperonyl butoxide. Sesamex appeared to be as effective a synergist as piperonyl butoxide, and sulfoxide and propyl isome were almost as effective, but the sesame-oil extractives were much less so.

The effect of piperonyl butoxide on Sevin was also beneficial in baits of sugar solution, supplied to house-flies for 24 hours, in which doses of 5 and 10 mg. insecticide per 100 ml. gave 3 and 28 per cent. mortality, respectively, alone and 60 and 100 per cent. with five times as much synergist; in sprays applied to *Aphis fabae* Scop. in which 0·2 and 2 mg. Sevin per 100 ml. gave 0 and 40 per cent. mortality, respectively, alone and 25 and 94 per cent. with ten times as much synergist; and in topical applications to adult males of *Blattella germanica* (L.), in which 5 and 10 μg. Sevin per insect gave 0 and 5 per cent. mortality alone and 90 and 100 per cent. with ten times as much synergist, respectively.

Moorefield (H. H.) & Tefft (E. R.). **Evaluation of 2-(3,5-dichloro-2-biphenylyloxy)triethylamine as an insecticide adjuvant.** —*Contr. Boyce Thompson Inst.* **20** (1959) no. 4 pp. 293–298, 20 refs. Yonkers, N.Y., 1960.

The following is based on the authors' summary. In the tests described, 2-(3,5-dichloro-2-diphenylyloxy)triethylamine, which extends the activity of

a diverse series of unrelated drugs through inhibition of metabolic transformation, but is itself non-toxic to insects, effectively synergised 3-tert.-butylphenyl N-methylcarbamate, Sevin, Pyrolan and Isolan, but not pyrethrins, allethrin, cyclethrin, DDT, diazinon or malathion in topical applications to adults of *Musca domestica* L., and did not inhibit DDT-dehydrochlorinase, the detoxication enzyme from DDT-resistant flies, *in vitro*.

The results indicate that synergism of the pyrethrins and the carbamates is not a correlative phenomenon and that, although some compounds have been shown to increase the action of both classes of toxicants, specific carbamate synergists exist.

Bakker (K.). **Feeding period, growth, and pupation in larvae of** *Drosophila melanogaster*.—*Ent. exp. appl.* **2** no. 3 pp. 171–186, 6 graphs, 12 refs. Amsterdam, 1959. (With a summary in German.)

The following is based on the author's summary. When larvae of *Drosophila melanogaster* Mg. were removed from their food after different periods and kept in culture jars without food, the minimal feeding period necessary for the completion of development was 48 hours at 25°C. [77°F.] and the larvae had to have reached at least the third instar. Puparium formation was delayed for those feeding for not more than 48 hours, but the sex ratio was not affected, though the adults were much below normal weight. Data on the changes in larval weight are recorded.

Lewis (T.). **The annual cycle of** *Limothrips cerealium* **Haliday (Thysanoptera) and its distribution in a wheat field.**—*Ent. exp. appl.* **2** no. 3 pp. 187–203, 9 figs., 12 refs. Amsterdam, 1959. (With a summary in French.)

Observations in an experimental wheat field in England indicated that the life-cycle of *Limothrips cerealium* (Hal.) can be arbitrarily divided into six stages based primarily on the amount of flight activity. The females feed mainly on winter cereals and grasses in spring, many moving to later sown cereals in June and July, where most eggs are laid in the sheaths of the young leaves. The larvae develop on the cereals, and first-generation females leave the cereals in August to feed on grasses before entering hibernation, the males dying soon after pairing. Wheat ears with a water content of less than about 45 per cent. were not favoured. When winds blew consistently from the same quarter, the initial infestation was greatest on the windward edge of the crop.

Lewis (T.). **A comparison of water traps, cylindrical sticky traps and suction traps for sampling Thysanopteran populations at different levels.**—*Ent. exp. appl.* **2** no. 3 pp. 204–215, 1 graph, 14 refs. Amsterdam, 1959. (With a summary in French.)

The following is virtually the author's summary. Thysanoptera drifting over and around a wheat field in England were trapped using black, green and white water traps, black cylindrical sticky traps and suction traps. Certain *Taeniothrips* spp., *Thrips* spp. and *Aeolothrips* spp. were strongly attracted to white but not to green or black; *Limothrips cerealium* (Hal.),

Chirothrips manicatus Hal. and *Stenothrips graminum* Uzel were not markedly attracted to any of these colours. At crop level, suction traps gave more consistent catches than either the sticky or water traps; at higher levels, catches from sticky traps were more consistent than those from water traps. Up to 48 ft., the aerial density of all species decreased with height, but the rapidity of the decrease differed between species.

BARNES (H. F.), MILLER (B. S.) & ARNOLD (M. K.). **Some factors influencing the emergence of overwintering hessian fly larvae.**—*Ent. exp. appl.* **2** no. 3 pp. 224–239, 2 refs. Amsterdam, 1959. (With a summary in German.)

The following is virtually the authors' summary of this account of investigations at Rothamsted. Overwintering fully fed larvae of *Mayetiola destructor* (Say) in puparia respond to experimental conditions of constant temperature and relative humidity progressively faster as the normal time of pupation and emergence in the spring approaches. Frost does not speed up emergence. A constant temperature of 15 or 20°C. [59 or 68°F.] at 95 per cent. relative humidity is recommended for the production of midges for experimental purposes from overwintering puparia.

TANADA (Y.). **Descriptions and characteristics of a nuclear polyhedrosis virus and a granulosis virus of the armyworm,** *Pseudaletia unipuncta* **(Haworth) (Lepidoptera, Noctuidae).**—*J. Insect Path.* **1** no. 3 pp. 197–214, 4 figs., 16 refs. New York, N.Y., 1959.

Three virus diseases have been reported to attack the larvae of *Pseudaletia unipuncta* (Haw.), a nuclear polyhedrosis known for many years [*cf. R.A.E.*, A **3** 356], a granulosis virus that occurs in Hawaii [**45** 96] and certain areas in the United States, and a non-inclusion virus. The symptoms, histopathology and laboratory characteristics of the first two are described. Both of these may occur in the same insect. They proved to be specific to *P. unipuncta* in laboratory tests, and *P. unipuncta* was not susceptible to the nuclear polyhedrosis of *Spodoptera mauritia* (Boisd.) or the granulosis of *Pieris rapae* (L.).

TANADA (Y.). **Synergism between two viruses of the armyworm,** *Pseudaletia unipuncta* **(Haworth) (Lepidoptera, Noctuidae).**—*J. Insect Path.* **1** no. 3 pp. 215–231, 8 refs. New York, N.Y., 1959.

The following is virtually the author's summary. Dead larvae of *Pseudaletia unipuncta* (Haw.) collected from virus epizootics in field populations in Hawaii may contain either the nuclear polyhedrosis virus or the granulosis virus or both [*cf.* preceding abstract]. Only the nuclear polyhedrosis virus is evident in most of the dead larvae. The virulence of the remains of dead larvae is dependent largely on the proportion and concentration of the two viruses within them. The addition of the granulosis virus to larval remains with predominantly nuclear polyhedrosis virus greatly increases the virulence of such remains. This indicates that synergism may play an important rôle in virus epizootics in field populations of the armyworm. The feeding of the viruses at various intervals of time indicates that the larva is most susceptible when fed the two viruses at the same time. An initial feeding

of the granulosis virus followed by the feeding of the nuclear polyhedrosis virus increases the susceptibility of the armyworm more than the initial feeding of the nuclear polyhedrosis virus followed by the granulosis virus. The heat-inactivated granulosis virus is still capable of enhancing the virulence of unheated nuclear polyhedrosis virus, but heat-inactivated nuclear polyhedrosis virus has no apparent effect on the unheated granulosis virus. This suggests that the granulosis virus is the better synergist. Inasmuch as the heat-inactivated granulosis virus within its inclusion body retains its synergistic properties, the hypothesis that the granulosis virus is composed of two components, an invasive portion and an infective portion, is proposed.

Stevenson (J. P.). **Epizootiology of a disease of the desert locust, *Schistocerca gregaria* (Forskål), caused by nonchromogenic strains of *Serratia marcescens* Bizio.**—*J. Insect Path.* **1** no. 3 pp. 232–244, 4 graphs, 16 refs.. New York, N.Y., 1959.

The following is virtually the author's summary. Experiments on the epizootiology of a disease of *Schistocerca gregaria* (Forsk.) caused by a non-chromogenic strain of *Serratia marcescens* [*cf. R.A.E.*, A **48** 412] indicated that the practice of cannibalism by the locusts is one of the more important factors in transmission of the bacterium. Faecal contamination appears to be less important, but may provide a means whereby the disease could become enzootic. Methods are discussed by which epizootics can be produced in caged communities. Some aspects of experimental epizootiology in the field are mentioned.

Drake (E. L.) & McEwen (F. L.). **Pathology of a nuclear polyhedrosis of the cabbage looper, *Trichoplusia ni* (Hübner).**—*J. Insect Path.* **1** no. 3 pp. 281–293, 17 figs., 11 refs. New York, N.Y., 1959.

The following is virtually the authors' summary. The histopathological symptoms in larvae of *Trichoplusia ni* (Hb.) infected with the nuclear polyhedrosis virus investigated by McEwen & Hervey [*R.A.E.*, A **48** 23] are similar to those described for nuclear polyhedroses in other Lepidoptera. The polyhedra multiply in the nuclei of certain blood cells, the fat-body, the hypodermis and the tracheal matrix. Polyhedra can first be detected in the fat-body nuclei, and do not appear in the blood cell nuclei until a much later stage of infection. Low-temperature rearing of infected larvae increases the time required to produce mortality with a given dosage of virus inoculum. Infection with virus appears first to increase food consumption, later to decrease food intake. Although infected larvae gain weight at a normal rate in the initial stages of infection, infected larvae near death weigh less than healthy larvae of the same age.

Kramer (J. P.). **On *Nosema heliothidis* Lutz and Splendor, a Microsporidian parasite of *Heliothis zea* (Boddie) and *Heliothis virescens* (Fabricius) (Lepidoptera, Phalaenidae).**—*J. Insect Path.* **1** no. 3 pp. 297–303, 18 figs., 6 refs. New York, N.Y., 1959.

The following is largely the author's summary. Microsporidia found in dead and moribund larvae of *Heliothis zea* (Boddie) and *H. virescens* (F.) in North Carolina and Illinois were identified as *Nosema heliotidis*, which was originally described from Brazil and also occurs in California and Maryland.

Observations showed that *N. heliotidis* attacks the walls of the ventriculus, and the principal stages in its developmental cycle are described. It is concluded that it can afford considerable control in the field.

Lipa (J. J.) & Steinhaus (E. A.). *Nosema hippodamiae* **n.sp., a Microsporidian parasite of** *Hippodamia convergens* **Guérin (Coleoptera, Coccinellidae).**—*J. Insect Path.* **1** no. 3 pp. 304–308, 11 figs. New York, N.Y., 1959.

Microsporidia found infecting *Hippodamia convergens* (Guér.) in California in 1959 are described as *Nosema hippodamiae*, sp.n. No previous record of such infection of a Coccinellid is known.

Baranowski (R. M.). **Notes on the biology of the royal palm bug,** *Xylastodoris luteolus* **Barber (Hemiptera, Thaumastocoridae).**—*Ann. ent. Soc. Amer.* **51** no. 6 pp. 547–551, 5 figs., 5 refs. Washington, D.C., 1958.

Xylastodoris luteolus Barber occurs on royal palm, *Roystonea regia*, in southern Florida and Cuba [*cf. R.A.E.*, A **10** 120; **13** 89] and is not known elsewhere. Attempts to rear the bug in the laboratory in Florida failed, but it was successfully reared in organdie tubes fastened over the leaflets of palms in the open, and the following is based on the author's summary of the observations made. The eggs are laid among the membranous scales covering the lower surface of the midrib and hatch in 8–9 days. The nymphs feed on the folded leaflets, causing them to turn brown, and become full-fed in 28 days. The males are more numerous than the females, and younger palms are preferred.

Oatman (E. R.) & Michelbacher (A. E.). **The melon leaf miner,** *Liriomyza pictella* **(Thomson) (Diptera: Agromyzidae).**—*Ann. ent. Soc. Amer.* **51** no. 6 pp. 557–566, 4 figs., 16 refs. Washington, D.C., 1958. **II. Ecological studies.**—*Op. cit.* **52** no. 1 pp. 83–89, 4 figs., 4 refs. 1959.

The following paragraphs are based largely on the authors' abstracts, respectively.

Liriomyza pictella (Thoms.) [*cf. R.A.E.*, A **45** 480] is widespread at relatively low elevations in California, where it causes great damage to melon, bean, lucerne and other crops in the San Joaquin Valley. The injury is due mainly to the serpentine mines made by the larvae, usually in the palisade layer of the leaves, but also to the feeding and oviposition punctures of the females. The Agromyzid apparently overwinters as a pupa in the soil and plant débris; adults appear in April, and peak populations, which may be extremely large, are reached in August. Under greenhouse conditions, the adults emerged during the morning, and females were about 5 per cent. more numerous than males. Mating usually occurred within 24 hours, and oviposition began 12–24 hours later. The eggs were usually laid in the morning and were placed in the upper leaf surface. Females in constant association with males laid an average of 688 fertile eggs, at the rate of 35–40 per day for a week or more, beginning after about three days,

and declining to 3–5 per day after 30 days. About five out of every six punctures made by the females were used only for feeding, but the adults, especially males in the absence of females, also fed on natural plant exudations. Adult males, females constantly associated with males and females separated from males lived for averages of 30, 42·6 and 36·5 days, respectively. The larvae entered the leaves on hatching, but left their mines when fully fed, usually in the early morning, and most pupated just below the soil surface. The pupal stage lasted 7–11 days in the greenhouse.

Survival of the immature stages was highest at 27·8°C. [82°F.], and the development period varied from 12·1 days at 32·2°C. [90°F.] to 65·3 days at 12·8°C. [55°F.]. The interval between leaving the larval mine and pupation increased greatly and abruptly at temperatures below 18°C. [64·4°F.], and pupation was difficult and pupal mortality complete at temperatures below 10°C. [50°F.] or above 35°C. [95°F.]. Full-fed larvae were negatively phototactic and positively thigmotactic, tending to crawl under shelter or burrow in the soil to pupate, and pupating sooner under semi-dark conditions than in natural light. Relative humidity had no appreciable effect on the length of the pupal stage, but the interval before pupation and the pupal mortality at 5 or 96 per cent. relative humidity were almost twice those at 67 per cent.; the optimum range of humidity for pupation and adult emergence was 30–70 per cent. Sieved topsoil provided the best substrate for the pupae; pupal mortality was highest under natural light, regardless of substrate, and lowest on a soil substrate in semi-dark conditions. When adults were kept without food or moisture, several lived for 16 days at a constant temperature of 7·2°C. [45°F.], but there was complete mortality in 8–12 hours at 90°F. No adults died when exposed for 24 hours to constant temperatures of 0 or −2·78°C. [32 or 27°F.], but mortality averaged 38 per cent. at −7·78°C. [18°F.]; females were more resistant than males. Adults lived for an average of 12·3 days on a diet of honey, 1·5 days on a protein hydrolysate and 1·1 days on water alone, females in all instances living longer than males.

Milliron (H. E.). **A new *Anicetus* parasite of the tuliptree scale (Hymenoptera: Encyrtidae).**—*Ann. ent. Soc. Amer.* **52** no. 1 pp. 28–30, 2 refs. Washington, D.C., 1959.

Anicetus toumeyellae, sp.n., is described from adults of both sexes reared from *Toumeyella liriodendri* (Gmel.) during an outbreak of this Coccid on tulip tree [*Liriodendron*] and magnolia in Delaware in 1950.

Dickson (R. C.). **On the identity of the spotted alfalfa aphid in North America.**—*Ann. ent. Soc. Amer.* **52** no. 1 pp. 63–68, 10 refs. Washington, D.C., 1959.

The following is based largely on the author's abstract. Comparison with Indian cotypes of *Therioaphis maculata* (Buckt.) confirmed that the pest of lucerne known in the United States as the spotted alfalfa aphid belongs to that species [*cf. R.A.E.*, A **45** 11]. Examination of material from various countries showed that there is considerable variation in the species as it occurs in the Old World, but very little in the United States, where it seems identical with specimens received from Israel, Cyprus and Morocco. The proportion of the third antennal segment covered by sensoria and the size of the ventral sclerotised abdominal dashes were found of particular value in characterising local populations and in distinguishing populations and

specimens of *T. maculata* from those of *T. trifolii* (Monell), which infests clovers in the United States and was at one time confused with it.

Barnes (M. M.). **Radiotracer labeling of a natural Tephritid population and flight range of the walnut husk fly.**—*Ann. ent. Soc. Amer.* **52** no. 1 pp. 90–92, 1 fig., 5 refs. Washington, D.C., 1959.

About 15 per cent. of a naturally occurring population of *Rhagoletis suavis completa* Cress. in a five-acre walnut grove in California were labelled within 26 hours by spraying small areas of foliage on 15 trees with a water solution including 5 per cent. of a liquid maize protein hydrolysate, a powerful attractant, containing 0·05 mc ^{32}P per ml. The recovery of radioactive flies in traps at various distances from the baited trees showed that populations redistributed themselves fairly rapidly through the grove and that the comparatively mature population there contributed about 7 per cent. of the individuals in the surrounding area, to a distance of 0·125 mile, and about the same proportion in an orchard 0·3 mile away. As labelled flies were caught almost a mile away in the third week after baiting, it is concluded that the species may easily spread a few miles in a season under reasonably favourable conditions. In the treated orchard, 56 per cent. of the females contained eggs, and radioactive eggs were readily collected from the walnuts.

Jacobson (L. A.) & Blakeley (P. E.). **Development and behavior of the army cutworm in the laboratory.**—*Ann. ent. Soc. Amer.* **52** no. 1 pp. 100–105, 4 graphs, 13 refs. Washington, D.C., 1959.

Severe infestations of *Chorizagrotis auxiliaris* (Grote) have occurred annually on grain and forage crops in Alberta and Saskatchewan since 1955, and laboratory tests on the development and behaviour of the Noctuid were therefore made [*cf. R.A.E.*, A **47** 448]. The following is based largely on the authors' abstract of the results. The eggs hatched at temperatures only slightly above freezing point, and, at 25°C. [77°F.], 66 and 24 per cent. did so at 100 and 0 per cent. relative humidity, respectively. At 25°C., the egg, larval and pupal stages lasted 5·3, 48 and 19·2 days, respectively, and the moths lived for up to 90 days if provided with honey solution and for up to 20 if given only water. The developmental stages and preoviposition period varied inversely with temperature, and the optimum for oviposition was near 20°C. [68°F.], at which egg-laying continued for about 30 days. The females laid 1,000 eggs or more each. More eggs were laid in continuous darkness than in continuous light, and at 68°F., the preoviposition and oviposition periods were prolonged when the daily photoperiod was 16 hours or longer and reduced when it was shorter. Larvae that fed on dandelion had fewer instars and a shorter larval period than those that fed on lucerne, and gave rise to heavier pupae and to moths that laid more eggs.

Doane (C. C.). *Beauveria bassiana* **as a pathogen of** *Scolytus multistriatus*. —*Ann. ent. Soc. Amer.* **52** no. 1 pp. 109–111, 1 graph, 9 refs. Washington, D.C., 1959.

The following is based on the author's abstract. In a search for pathogens that might help to control *Scolytus multistriatus* (Marsham) on elm in

Connecticut, *Beauveria bassiana* proved to be the most abundant and was found in overwintering larvae in elm bark collected in five widely separated areas. Up to 6·5 per cent. of overwintering larvae in trees from city streets were infected, but the fungus was much more effective in other environmental conditions. In one epizootic, 97 per cent. of the larvae were killed in a shady grove near a pond and only 4 per cent. in trees in the open. In laboratory experiments, 92, 87 and 61 per cent. of larvae, pupae and adults, respectively, were killed when exposed to elm-bark sawdust inoculated with spores of *B. bassiana* and kept at 24°C. [75·2°F.] and 72 per cent. relative humidity for nine days.

Shands (W. A.) & Simpson (G. W.). **Characteristics of aphid-population growth on potatoes in northeastern Maine.**—*Ann. ent. Soc. Amer.* **52** no. 2 pp. 117–121, 1 graph, 16 refs. Washington, D.C., 1959.

Four aphids are important on potato in north-eastern Maine, *Aphis nasturtii* Kalt. (*abbreviata* Patch), *Myzus persicae* (Sulz.), *Macrosiphum* (*Myzus*) *solani* (Kalt.), and *Macrosiphum euphorbiae* (Thos.) (*solanifolii* (Ashm.)). Since effective control depends on careful timing of insecticide applications, studies were begun in 1941 on their seasonal history and abundance. Certain fairly constant characteristics of population growth were observed, and the following is based on the author's abstract of the results.

The average over-all population trend of the four species was represented by a sigmoid curve, the peak of which was reached about 20th August. During 15 years, the average number of apterae of the four species, counted by the three-leaf method, ranged at the peak from 61 to 2,700 per plant. The population was seldom, if ever, limited by factors dependent on density. Rapidity of decline after the peak varied greatly from year to year. Phenomena recognised as population growth characteristics were represented by points or measurable intervals between points on the upward swing of the curve. All these characteristics appear to depend basically on the tendency of the apterae to move laterally to unpopulated plants early in the summer and vertically to the less densely populated parts of the plants later. Population growth early in the season is expressed more meaningfully by the percentage of plants infested than by the number of aphids per plant, but better by the latter method once all the plants become infested. Although there are limitations to its use, knowledge of these growth characteristics proved beneficial in obtaining adequate control from fewer applications of insecticides and at reduced cost.

Staples (R.) & Allington (W. B.). **The efficiency of sticky traps in sampling epidemic populations of the Eriophyid mite** *Aceria tulipae* **(K.), vector of wheat streak mosaic virus.**—*Ann. ent. Soc. Amer.* **52** no. 2 pp. 159–164, 1 fig., 10 refs. Washington, D.C., 1959.

In 1953, tests were made in Nebraska on the efficiency of traps of the wind-vane type in trapping *Aceria tulipae* (Keifer), the vector of the wheat streak mosaic virus [*cf. R.A.E.*, A **43** 270]. The traps, which were placed in fields of winter wheat and self-sown wheat, were of different heights and trapping surface areas, and the following is based on the authors' abstract of the results. In seven out of 11 paired comparisons, 1 × 3 in. grease-coated slides were more efficient on a unit-area basis than 3 × 4 in.

slides, and in five of these instances the smaller slides caught as many as the larger. Trapping efficiency was not increased by a funnel in front of the trapping surface. Statistical analysis showed that mite populations in self-sown wheat could be measured satisfactorily by the trapping method, and where a population was uniform a good estimate of it was provided by a single trap. The mean number of mites per day from seven traps on the margins of winter-wheat fields was significantly greater than that of 13 traps in fields at some distance from the source of infestation in self-sown wheat; means of the individual trap collections did not differ significantly. The mean number of mites per day for 23 days from eight traps in self-sown wheat were significantly correlated with those from 13 traps in winter-wheat fields and field margins. This correlation should exist if the trapping method is efficient in measuring daily fluctuations in numbers of air-borne mites.

Barsa (M. C.) & Ludwig (D.). **Effects of DDT on the respiratory enzymes of the mealworm, *Tenebrio molitor* Linnaeus, and of the house fly, *Musca domestica* Linnaeus.**—*Ann. ent. Soc. Amer.* **52** no. 2 pp. 179–182, 1 graph, 11 refs. Washington, D.C., 1959.

Experiments were undertaken to determine the *in vitro* effects of DDT on the activities of respiratory enzymes of larvae of *Tenebrio molitor* L. and *Musca domestica* L., and the following is virtually the authors' abstract of the findings. The amount of inhibition caused by 10^{-3} M DDT increased with a decrease in enzyme concentration, both with cytochrome oxidase [*cf. R.A.E.*, A **45** 435, etc.] and succinic dehydrogenase, in the homogenates; hence. DDT appears to be irreversible in its action. It is an inhibitor of cytochrome oxidase and succinic dehydrogenase, but not of alcohol, glucose, lactic, alphaglycerophosphate or isocitric dehydrogenases or of the malic enzyme. It inhibits only the cyanide-sensitive respiration. The inhibition of the cytochrome-oxidase activity of a 0·3 per cent. homogenate of the larvae of *M. domestica* was 65 per cent. This inhibition remained constant over a two-hour period.

Messenger (P. S.) & Flitters (N. E.). **Effect of variable temperature environments on egg development of three species of fruit flies.**—*Ann. ent. Soc. Amer.* **52** no. 2 pp. 191–204, 5 graphs, 56 refs. Washington, D.C., 1959.

The following is virtually the authors' abstract. Eggs of *Dacus dorsalis* Hend., *D. cucurbitae* Coq. and *Ceratitis capitata* (Wied.) were incubated under variable temperatures in automatically controlled, air-conditioned bioclimatic chambers [*cf. R.A.E.*, A **42** 8]. Idealised temperature patterns with fixed periodicities and diurnal ranges, and natural temperature patterns characteristic of many localities in the United States, were studied [*cf.* **43** 310]; the results of both types of thermal environments, which were closely alike, were compared with constant-temperature results previously reported [**47** 132]. Only at medial thermal levels (65–85°F.) do egg development rates under regularly fluctuating temperatures agree closely with those at constant temperatures; at these levels, differences in the diurnal temperature range cause little or no change in rates. Below this medial zone, under variable temperatures there is an acceleration of development and in the upper thermal levels a deceleration of development, relative to that resulting from constant-temperature exposures; and the greater the diurnal

variation, the greater are these effects. Exposures at the lower levels involved temperatures near or even below the constant-temperature threshold; in several cases completed development occurred after exposure to mean temperatures several degrees below that threshold. Mean temperatures at high-level exposures never exceeded the constant-temperature upper developmental limit. Swiftest egg development under fluctuating temperature conditions occurred at mean temperatures 5–10°F. below the temperature for most rapid growth under constant conditions; this maximum development rate was somewhat less under fluctuating conditions than when temperatures were constant. When developmental rates for the egg stage are plotted against means of the fluctuating temperatures encountered during exposure, the resulting curves, though exhibiting some slight sigmoidal character at the extremities, approach rather closely a rectilinear relation. This is in contrast to the much more pronounced sigmoidal relation of the corresponding curves noted in constant-temperature studies.

Kring (J. B.). **The life cycle of the melon aphid, *Aphis gossypii* Glover, an example of facultative migration.**—*Ann. ent. Soc. Amer.* **52** no. 3 pp. 284–286, 1 fig., 13 refs. Washington, D.C., 1959.

The annual cycle of *Aphis gossypii* Glov. has long been in doubt, but a recent finding in Connecticut that it produces winter eggs on *Catalpa bignonioides* indicates that it conforms to the currently accepted pattern for a migratory aphid. Examination of *Hibiscus syriacus* (rose of Sharon) there in the autumns of 1954–56 showed the presence of male and female aphids that were indistinguishable from the sexuales of *A. gossypii* on *Catalpa*, the males being winged on both plants. Eggs were laid on *H. syriacus* in October and November, and they hatched in April and early May, the aphids that developed giving rise to colonies. Migratory forms from both plants readily colonised cotton, producing the diminutive yellow forms described on dock (*Rumex crispus*), but establishment was difficult on cucumber. Transfers were made readily between *Catalpa* and *H. syriacus*. *A. gossypii* was observed throughout the growing season on the two plants, and *Catalpa* was heavily infested in August 1955. Sexuales were produced both by migrants and by individuals that had remained on the plant throughout the season. The summer forms on *Catalpa* in July–August 1957 were all diminutive yellow aphids, and they showed no evidence of growth during this period, in which the leaves wilted during the day because of the heat. When such aphids were transferred to cuttings of *H. syriacus* in nutrient solution in the laboratory, growth and reproduction were resumed, the new generation being multicoloured. Cuttings in distilled water were less favourable, growth and reproduction being limited and the forms produced being predominantly diminutive and yellow.

Foote (R. H.) & Thomas (C. A.). *Mycophila fungicola* **Felt: a redescription and review of its biology (Diptera, Itonididae).**—*Ann. ent. Soc. Amer.* **52** no. 3 pp. 331–334, 14 figs., 15 refs. Washington, D.C., 1959.

In view of increased injury to cultivated mushrooms by *Mycophila fungicola* Felt [*cf. R.A.E.*, A **31** 205] in part of Pennsylvania, all stages except the egg of this Cecidomyiid are described and its bionomics are reviewed; some of the larvae reproduce paedogenetically [*cf.* **47** 269, etc.].

Harrison (J. O.). **Notes on the life history and habits of** *Ceramidia butleri* **Moeschler, a pest of bananas (Lepidoptera: Syntomidae).**—*Ann. ent. Soc. Amer.* **52** no. 4 pp. 351–354, 5 figs., 5 refs. Washington, D.C., 1959.

Ceramidia butleri (Möschl.) is the most destructive of the species of its genus that attack banana in Costa Rica. The larvae feed on the leaves, injuring them so severely as to reduce fruit size and weight, and the bionomics of the Syntomid were therefore investigated in the laboratory. It was found that the egg, larval and pupal stages last 5–6, 18–23 and 9 days, respectively, the adults surviving for 3–6 days. The eggs and larvae occur on the lower surfaces of the leaves, as also do the pupae, though a few larvae pupate behind the leaf sheaths on the side of the pseudostem. During its final instar, the larva consumes more leaf tissue than during all the preceding ones together.

DeBach (P.). **New species and strains of** *Aphytis* **(Hymenoptera, Eulophidae) parasitic on the California red scale,** *Aonidiella aurantii* **(Mask.), in the Orient.**—*Ann. ent. Soc. Amer.* **52** no. 4 pp. 354–362, 1 fig., 5 refs. Washington, D.C., 1959.

As the effectiveness of *Aphytis chrysomphali* (Merc.) and *A. lingnanensis* Comp. as parasites of *Aonidiella aurantii* (Mask.) on *Citrus* in California is limited by climate [*cf. R.A.E.*, A **46** 263], further parasites of the Coccid belonging to the same group were imported from the Far East. They included a form of *A. hispanicus* (Merc.) from Assam and a form of *A. citrinus* Comp. from Kagoshima, Japan, neither of which survived shipment, and two species described as *A. melinus*, sp.n., from India and West Pakistan, and *A. fisheri*, sp. n., from Burma, which were released in California and subsequently recovered. A key to the adult females of these four and *A. lingnanensis* is given, with notes on their habits.

Klostermeyer (E. C.). **Alfalfa seed insects.**—*Bull. Wash. agric. Exp. Stas* no. 587, 14 pp. [Pullman, Wash.] 1958.

In Washington State, control of *Lygus*, particularly *L. elisus* Van D. and *L. hesperus* Knight, is essential if high yields of lucerne seed are to be obtained from the crop that develops after the first cutting, and this was confirmed in experiments carried out in 1952–56, in which control of *Macrosiphum pisum* (Harris) and *Tetranychus telarius* (L.), which were not numerous, resulted in no yield increase. The experiments are described, and the quantities of insecticide given were applied in 20–25 U.S. gal. emulsion spray per acre.

A single application of 2 lb. DDT resulted in the highest yield each year; this treatment gave consistently good control of *Lygus*, with a long residual effect against the nymphs, and reduced the aphid population, but resulted in increases in the number of mites. The addition of other insecticides had little effect against the Mirid, but sometimes improved aphid or mite control. Of other materials tested against *Lygus*, 0·5 lb. endrin was effective in the two years in which it was tested, with a residual effect at least as good as that of DDT, one application of 3 lb. toxaphene gave good control but permitted an increase of nymphs late in the season, whereas two were effective throughout the season, 0·25–0·5 lb. dieldrin was generally less

effective than these, and 0·5 lb. heptachlor gave poor control. No resistance of *Lygus* to DDT was observed in 1952–54, but some loss of control, without loss of yield, was indicated in 1955–56.

Either alone or in mixtures with other materials, 0·25–0·5 lb. parathion, 0·5 lb. demeton and 1 lb. Trithion were generally effective against the aphid, and toxaphene was slightly better than DDT; 1·5–2 lb. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] and 0·5 lb. demeton generally gave good reductions of mite populations, whereas parathion was effective in some years, but not in others.

Quinton (R. J.). **The alfalfa weevil.**—*Bull. Conn. agric. Exp. Sta.* no. 621, 16 pp., 8 figs., 9 refs. New Haven, Conn., 1959.

Hypera variabilis (Hbst.) (*postica* (Gylh.)) was found in Connecticut in May 1957 [*cf.* also *R.A.E.*, A **41** 283] and appears to have become established there, but it is not yet known whether it will become an important pest. The author describes the injury caused by it to lucerne, gives a short account of its life-history and describes all stages, with characteristics of size, colour and habit that distinguish it from other weevils found on lucerne in the State.

In tests on control in 1958, heptachlor was applied at 0·25 lb. per acre in 30 U.S. gal. emulsion spray on 18th April or 13th May or at 1 lb. per acre in 2·5 per cent. granules mixed with sand on 18th April, and periodic counts of larvae showed that the early treatments, directed against the adults, were effective in preventing reproduction; there were no significant differences between them after 33 days, but the granules were evidently superior by the 39th day and provided protection until harvest. The late spray, applied when the plants were 12–14 in. tall, gave good results for 22 days, after which there were no significant differences between early and late sprays, neither giving protection until harvest. Samples taken in early June showed increases in yield of 18·5, 1·6 and 5·8 per cent. from plots treated with the granules and early and late sprays, respectively; the result for the granules was largely due to elimination of *Philaenus leucophthalmus* (L.), which was controlled by them but not by the sprays. Examination during the period of second growth showed a reduction in infestation by *H. variabilis* on 9th July and increases in plant height and yield on 1st August after the granular treatment, probably as a result of control on the first crop and some residual control of stragglers of the overwintered population, which continued to oviposit on the second crop. There were only slight differences between sprayed and untreated plots.

Mueller (K. E.) & Lange (W. H.). **Stem borer found on safflower.**—*Calif. Agric.* **13** no. 3 pp. 4–5, 5 figs. Berkeley, Cal., 1959.

In 1958, *Melanagromyza virens* (Lw.), which attacks many wild and cultivated plants in the United States, caused 100 per cent. infestation of late-planted experimentally-grown safflower [*Carthamus tinctorius*] at Davis, California. The eggs were apparently laid in young terminal and lateral shoots, and the larvae bored downwards in these until they reached the woody part of the main stem. They pupated in the stems, and up to ten larvae and puparia were found in a single one. There is probably only one generation a year. As a result of infestation, the shoots wilted, particularly in the afternoon, chlorotic or necrotic areas appeared on the leaves, and

severely affected shoots died. Losses of yield cannot be accurately estimated, but there is little evidence of damage to commercial crops grown under dry-land conditions, as these mature too rapidly to be severely attacked. Late plantings and crops on irrigated land remain succulent longer and would thus be more susceptible. The puparia were parasitised by *Halticoptera aenea* (Wlk.) and *Syntomopus americanus* Ashm., which presumably attack the larvae, and some collections of puparia, particularly overwintering ones, showed up to 80 per cent. parasitism by them.

Clark (E. C.). **Ecology of the polyhedroses of tent caterpillars.**—*Ecology* **39** no. 1 pp. 132–139, 22 refs. Brooklyn, N.Y., 1958.

The author reviews information on the ecology and other aspects of polyhedral virus diseases attacking Lepidoptera and describes an experiment carried out in New Mexico and Arizona in 1956 with two populations of a species of *Malacosoma* possibly distinct from, though referred to as, *M. fragile* (Stretch) [*cf. R.A.E.*, A **46** 125, etc.]. They occurred on quaking aspen (*Populus tremuloides*) in areas 190 miles apart, in one of which polyhedrosis was widespread and abundant, whereas none was found in the other, and egg-masses transferred from the infected to the uninfected area and from the uninfected to the infected one both gave rise to diseased larvae, indicating transmission of the virus through the egg and by contamination of the food-plant. No symptoms of polyhedrosis occurred in undisturbed egg-masses in the uninfected area. The possibility that the virus survives between insect outbreaks in polyhedra in the soil is discussed.

Blackith (R. E.). **Nearest-neighbour distance measurements for the estimation of animal populations.**—*Ecology* **39** no. 1 pp. 147–150, 7 refs. Brooklyn, N.Y., 1958.

The author discusses two formulae that have been proposed for relating the distance of organisms, chosen at random, from their nearest neighbours with the density of the population and concludes that such measurements can give useful supporting information about animal population estimates. Generally these methods can be used to investigate density if random dispersal is assumed and randomness if the density is known, but very little is known about their sensitivity to different kinds and degrees of non-random dispersal. Two capture-recapture experiments with grasshoppers are recorded as examples.

Huffaker (C. B.) & Kennett (C. E.). **A ten-year study of vegetational changes associated with biological control of Klamath weed.**—*J. Range Mgmt* **12** no. 2 pp. 69–82, 4 figs., 17 refs. Portland, Ore., 1959.

Data obtained since the establishment of *Chrysomela* (*Chrysolina*) *quadrigemina* Suffr. and the less effective *C.* (*C.*) *hyperici* Forst. against *Hypericum perforatum* in California in 1946 [*cf. R.A.E.*, A **39** 316] showed that control of the weed was excellent. It was due mostly to feeding by the larvae, which kept the plants in a defoliated condition over long periods when the food reserves in the roots were low and commonly caused mass destruction, whereas the adult feeding periods were too restricted in time to be effective. Larval sampling showed good correlation between the population density

of the insects and control of the weed. The adults survived at very low weed densities by feeding on such seedlings as appeared where all mature plants had been destroyed or on plants in shady areas, which are unattractive to ovipositing females and so are not completely destroyed. A small but widely dispersed population is thus able to survive to attack any local resurgence of the weed. Surveys of the changes in vegetation in areas in which *H. perforatum* had been controlled showed no alarming influx of noxious species and a great increase in forage of fair to good value, the local composition of which is discussed.

Watt (K. E. F.). **A mathematical model for the effect of densities of attacked and attacking species on the number attacked.**—*Canad. Ent.* **91** no. 3 pp. 129–144, 8 graphs, 50 refs. Ottawa, 1959.

Miller (C. A.). **The interaction of the spruce budworm, *Choristoneura fumiferana* (Clem.), and the parasite *Apanteles fumiferanae* Vier.**—*T.c.* no. 8 pp. 457–477, 5 graphs, 22 refs.

The second of these two papers contains an analysis of field data relating to the population densities of *Choristoneura fumiferana* (Clem.) on balsam fir (*Abies balsamea*) and white spruce (*Picea glauca*) and its parasite, *Apanteles fumiferanae* Vier., and the resulting parasitism, that had been collected since 1950 in north-western New Brunswick and a place in Nova Scotia during long-term studies on the population dynamics of the Tortricid [*cf. R.A.E.*, A **48** 141]. It was found that a mathematical model, which is described in the first paper, so far mimics the host-parasite relation that 71 per cent. of the variability in the number of hosts attacked is explained. For an understanding of the residual variation, field investigations on methods of assessing adult parasite density and controlled experiments on parasite behaviour and reproduction to provide a better understanding of the coefficients contained in the model and of the extent to which they are related to the physiology, morphology or behaviour of the parasite are needed.

Females of *A. fumiferanae* attack free-moving first-instar host larvae and also the first- and second-instar larvae in their hibernacula. Evidence was obtained that the females do not attack hosts at random, since parasitism is greater in the upper than in the lower half of the crown [*cf.* **43** 54]; after heavy mortality of balsam fir, hosts were less numerous and parasitism was lower on this tree, which is normally preferred by *C. fumiferana*, than on white spruce; female parasites were more strongly attracted to foliage of white spruce than to severely defoliated balsam fir in the laboratory; and superparasitism was infrequent. In New Brunswick, host populations increased gradually between 1945 and 1948, but whereas over much of the area they then increased rapidly to numbers that caused repeated defoliation until 1951, after which they declined rapidly, over the rest they fluctuated at considerably lower levels. Parasitism by *A. fumiferanae*, which was lower than 5 per cent. before 1949, also showed different trends; in the heavily infested area it increased slowly to reach 10 per cent. in 1955 and 20 per cent. in 1957, but elsewhere it reached 20 per cent. by 1950 and then fluctuated about this level.

The mathematical model accurately predicts the number of hosts attacked where infestation is relatively low, but overestimates it where defoliation causes a food shortage for the host. In a discussion of possible factors, not accounted for in the model, that may affect the parasite, it is stated that no evidence was obtained that the observed decrease in parasite efficiency where infestation was severe was caused by lowered fecundity or that it was

related to climatic factors, the food supply of the adult parasite, or the composition of the forest. Parasite survival is reduced when host density in the previous generation is high; possible causes are the increased mortality among host larvae, especially among the less active parasitised ones, during dispersal from the upper defoliated branches resulting from lack of food, and the production of a preponderance of male parasites, when, owing to the abundance of hosts, activation of the sperm may not keep pace with oviposition. The proportion of females fluctuated from 46 per cent. in 1951 and 1954 to 59 per cent. in 1957.

Cass (L. M.). **Damage to cabbage by the clover cutworm,** *Scotogramma trifolii* **(Rott.) (Lepidoptera: Phalaenidae).**—*Canad. Ent.* **91** no. 8 p. 477, 4 refs. Ottawa, 1959.

Hadena (*Scotogramma*) *trifolii* (Rott.) has rarely been recorded attacking cabbage, and its numbers were almost always negligible on it in the Ottawa Valley of Ontario during surveys in 1949–58. The larvae were commoner in the early summer of 1956, however, and were sufficiently injurious to cause monetary loss in a study field of early cabbage. The feeding injury resembles that due to *Pieris rapae* (L.), but is more confined to the developing head, which frequently becomes malformed. On 22nd June, infestation reached one larva per plant and exceeded that by *Plutella maculipennis* (Curt.) or *Trichoplusia ni* (Hb.), which are common pests of cabbage in the area.

Watson (W. Y.) & Arthur (A. P.). **Parasites of the European pine shoot moth,** *Rhyacionia buoliana* **(Schiff.), in Ontario.**—*Canad. Ent.* **91** no. 8 pp. 478–484, 1 map, 7 refs. Ottawa, 1959.

Following extensive planting of Scots and red pines (*Pinus sylvestris* and *P. resinosa*) in southern Ontario during the past 25 years, populations of *Rhyacionia buoliana* (Schiff.), which was accidentally introduced about 1925 [*cf. R.A.E.*, A **16** 191], have increased in importance on several exotic and native pines, of which these two and mugho pine (*P. mugo*) are the most susceptible. Local surveys of the parasites that attack the Tortricid were made in 1951 and 1953 [*cf.* **43** 155] and the species recorded are listed. Between 1954 and 1956, a survey covering the whole range of the moth in the Province was carried out. Some 22 species of Hymenopterous parasites and one Chloropid (doubtfully parasitic) were obtained from *R. buoliana* infesting twigs collected in 15 areas each year during the mid-larval (overwintering), late larval, early pupal and early larval stages, and notes on their abundance, distribution, dates of emergence and, in a few cases, bionomics are given. Total parasitism amounted to about 10 per cent. The commonest parasites were the native *Ephialtes* (*Calliephialtes*) *comstockii* (Cress.), *Hyssopus thymus* Gir., *Eurytoma pini* Bugbee [*cf.* **48** 254] and *Itoplectis conquisitor* (Say) and the introduced *Orgilus obscurator* (Nees); a complex of species of *Ephialtes* (*Scambus*), including at least *E.* (*S.*) *hispae* (Harris) and *E.* (*S.*) *tecumseh* (Vier.), was also frequently obtained. The other parasites occurred sporadically, and most were reared from the late larval and pupal stages. Of the common species, *O. obscurator* and *H. thymus* were the only ones reared from the overwintering larvae, and these two, with *Ephialtes comstockii*, *Eurytoma pini* and the species of the *hispae* complex also attacked the older larvae; all emerged from the pupae, though *O. obscurator* was scarce in this stage and most abundant in the overwintering larvae.

Only *H. thymus* emerged from the early-instar larvae. *O. obscurator* and *Cremastus* (*Temelucha*) *interruptor* Grav., an introduced parasite that was not reared in the present survey but was obtained in 1953, were both probably introduced accidentally with *R. buoliana*, since they were found in two places in Ontario before liberations had been made [*cf.* **43** 155], and it is therefore possible that introduced parasites may be spread with infested nursery stock. In 1933, *O. obscurator* was known from 20 and *C. interruptor* from 14 localities in Ontario, but abnormally low temperatures during early 1934 caused high mortality among the overwintering host larvae and the parasites in them. In 1936, *R. buoliana* was again common and the two parasites were recovered in three and two localities, respectively. *O. obscurator* was subsequently found in 14 and *C. interruptor* in six areas, and their distribution indicates that they are established where minimum winter temperatures lower than −10 and 0°F., respectively, are rare.

Ives (W. G. H.) & Prentice (R. M.). **Estimation of parasitism of larch sawfly cocoons by *Bessa harveyi* Tnsd. in survey collections.**—*Canad. Ent.* **91** no. 8 pp. 496–500, 2 refs. Ottawa, 1959.

The degree of parasitism of larvae of *Pristiphora erichsonii* (Htg.) on larch in Manitoba by *Ptychomyia selecta* (Mg.) (*Bessa harveyi* (Tns.)) was hitherto estimated from dissections of those cocoons, in samples collected in autumn from the soil in infested stands, that contained living sawfly larvae. The estimates were used in work already noticed [*R.A.E.*, A **44** 183] to provide an index of parasitism, but are of limited value, because they can be expressed only as percentages of sound cocoons parasitised, they may be based on collections from only one or two areas in the stand and may not, therefore, be representative of the whole, and they cannot indicate total parasitism, since some parasites emerge before collection. A different technique has therefore been adopted. Moss-filled trays, 4 sq. ft. in area, are placed beneath the crowns of the trees to catch the host larvae as they fall from them, the cocoons are collected from the trays in late September, and total parasitism is estimated as a percentage of the number of cocoons formed. The trays should be scattered throughout each plot, since parasitism within plots showed highly significant variability; it is calculated that 20 trays per ½-acre plot provide satisfactory estimates. Confidence limits for the proportion of cocoons containing parasites should be estimated by a quadratic approximation, and not by the conventional use of Student's *t* test.

Griffiths (K. J.). **Observations on the European pine sawfly, *Neodiprion sertifer* (Geoff.), and its parasites in southern Ontario.**—*Canad. Ent.* **91** no. 8 pp. 501–512, 2 graphs, 1 map, 32 refs. Ottawa, 1959.

Neodiprion sertifer (Geoffr.) occurs throughout most of south-western Ontario, but is not known elsewhere in Canada. Studies on its bionomics and parasites were made in 1953–55 in plantations of Scots pine (*Pinus sylvestris*), which is extensively planted in the area; oviposition studies were also made on red pine (*P. resinosa*) and jack pine (*P. banksiana*). In general, the seasonal history was similar to that observed in the United States [*cf. R.A.E.*, A **28** 487] and Europe. The eggs hatch during the first half of May, the fully developed larvae construct cocoons in the forest litter in the latter half of June, and adult emergence continues from early September until late autumn. Egg-clusters on Scots pine contained fewer eggs (an average of 87) than those recorded in Europe [*cf.* **25** 54], and were rather

larger than those on the two other trees. Mortality in the egg stage was about 5 per cent., as in Europe. Mortality in the larval stage reached 24·3 per cent., of which the greater part (22·6 per cent.) occurred during the first instar and was probably due to failure of the newly hatched larvae to become established. The percentage of sound cocoons (containing living prepupae of *N. sertifer* and developing parasites) in two small permanent sample plots in which a virus disease had been introduced in 1950 [*cf.* **41** 23] declined from 12·7 and 5·8 in 1953 to 6·2 and 1·4 in 1954. Adults emerged from 24·1–28·5 per cent. of the total number of cocoons in the plots; *Peromyscus maniculatus bairdi*, the only small mammal present, destroyed 12·3–17·7 per cent. of the cocoons [*cf.* **48** 323], and parasites and non-mammalian predators together accounted for 30·7–57·9 per cent. In 1953, 44·3 per cent. of the total emergence for the year took place after 8th October. Of 5,614 sound cocoons collected in the summer of 1952, 7·7 per cent. did not give rise to adults for approximately 15 months, and of 1,950 overwintered cocoons collected in the spring of 1952, 3 per cent. did not give rise to adults for 27 months [*cf.* **34** 39]. There was no spring emergence from overwintering populations.

Three Dipterous and 11 Hymenopterous parasites were reared from *N. sertifer*, two of the former and four of the latter for the first time, and a further ten parasites are known to attack the sawfly in the area [*cf.* **47** 446]. No parasites were reared from the eggs or feeding larvae, though one of the Ichneumonids, *Euceros frigidus* Cress., is known to parasitise feeding larvae of *N. pratti banksianae* Rohw. *Exenterus canadensis* Prov. emerged from cocoons containing prepupae reared from field-collected fully fed larvae, and the other parasites from field-collected cocoons containing prepupae. Total parasitism during the survey ranged from 8·1 to 29·1 per cent. of the sound cocoons, and was lower than is generally reported from Europe [**34** 39]. Parasitism by the individual species varied considerably with locality and year. The commonest species with, in brackets, the percentage of the total parasitism due to them, were the Bombyliid, *Hemipenthes sinuosa* (Wied.) (2·6–55·8); the Ichneumonids, *E. canadensis* (5·6–72·7), *Euceros frigidus* (0–40·1) and *Endasys subclavatus* (Say) (0–27·5); and the Eulophid, *Dahlbominus fuliginosus* (Nees) (0·6–13·3). All the parasites except *D. fuliginosus* overwintered in the host cocoons and emerged in the following year, most of the Hymenoptera in June, the remainder in July and August, and the Diptera in late July and early August. Adults of *D. fuliginosus* emerged during the year of attack or the following one, according to whether they were the progeny of adults of an early or a late summer generation. Small numbers of *Exenterus canadensis* and *H. sinuosa* emerged in the second year after attack.

Ives (W. G. H.). **A technique for estimating tamarack foliage production, a basis for detailed population studies of the larch sawfly.**—*Canad. Ent.* **91** no. 8 pp. 513–519, 1 graph, 6 refs. Ottawa, 1959.

The following is based partly on the author's summary. A technique for estimating the foliage production of larch, based on investigations already noticed [*R.A.E.*, A **48** 143], that provides bases for comparing the intensity of infestation by the larch sawfly [*Pristiphora erichsonii* (Htg.)] in stands of different composition and for studying the effect of the insect on its food-plant was developed in Manitoba. Analyses of the data show that branches should be sampled from three crown levels per tree. Stratification of the trees on the basis of crown depth and crown form is recommended. Stratified samples of six branches from each of 30 trees should provide

satisfactory estimates of amount of foliage per tree. Foliage weight increases in a linear manner as the season progresses, and the effects of this increase on a foliage sampling programme are discussed. Foliage sampling should coincide with the completion of linear foliage growth and be completed as quickly as possible, since differences due to the increase during a season may be as great as those between seasons or plots. The estimation of defoliation from samples taken before and after larval feeding must be supplemented by information on the percentage increase in foliage weight that occurs during the interval in order to avoid serious underestimation. Estimates of foliage production should probably be used only for comparisons of intensity of infestation in stands of different composition until it is known whether the increase in weight is accompanied by a change in nutritive value to the sawfly; if they are used to estimate the amount of food available, the data should be adjusted to compensate for the progressive increase in foliage weight.

Ryan (R. B.). **Termination of diapause in the Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins (Coleoptera: Scolytidae), as an aid to continuous laboratory rearing.**—*Canad. Ent.* **91** no. 8 pp. 520–525, 5 figs., 4 refs. Ottawa, 1959.

The following is based partly on the author's summary of this account of the development in Oregon of a method for terminating diapause in adults of *Dendroctonus pseudotsugae* Hopk. reared in the laboratory to provide stocks for investigations on control. Freshly emerged beetles were allowed to attack 3-ft. sections of recently cut Douglas fir (*Pseudotsuga menziesii*). After the progeny had developed in the logs at 75°F. for 40, 80 or 120 days, the logs were subjected to low temperatures ranging from 33 to 55°F. for 20, 50 or 90 days, after which they were placed in cages kept at 75°F. and the emerging beetles collected daily for 30 days. All logs were then debarked, and the remaining insects counted. The optimum temperature for termination of diapause was about 44°F. The minimum developmental period at 75°F. and the minimum duration of cold rest that was effective in terminating diapause lay between 40 and 80 and between 20 and 50 days, respectively. Cold treatment for 90 days was more effective than for 50 days. Adults in diapause have undeveloped flight muscles and gonads. Several generations a year can be reared in the laboratory by the procedures described.

Miller (L. A.) & McClanahan (R. J.). **Note on occurrence of the fungus *Empusa muscae* Cohn on adults of the onion maggot, *Hylemya antiqua* (Meig.) (Diptera: Anthomyiidae).**—*Canad. Ent.* **91** no. 8 pp. 525–526, 1 fig., 7 refs. Ottawa, 1959.

During work on the control of *Hylemyia antiqua* (Mg.) on onion near Toronto in 1958, dead adults in groups of up to ten were found in late September on the tips of the leaves of green bunching plants in one of numerous fields examined. They were most abundant in the outer three rows, which adjoined an uncultivated grassy area, and many showed signs of attack by a fungus, subsequently found to be *Entomophthora* (*Empusa*) *muscae*, between the abdominal terga and sterna. This fungus had not previously been reported from *H. antiqua* in Canada. Infested living adults were bloated, somewhat pale in colour and sluggish. The attack was

probably associated with the cool, humid weather that prevailed for about a week immediately before, but the exceptionally high numbers of *H. antiqua* that occurred in almost all the onion-growing areas in southern Ontario in 1958 are regarded as a possibly more significant factor. The outbreak persisted from mid-June to late October and was so severe that radish and spinach sown where infested onions had been disked under were attacked, despite the high food-plant specificity of *H. antiqua*.

Robinson (A. G.). **Note on fecundity of the pea aphid, *Acyrthosiphon pisum* (Harris), caged on plants of broad bean, *Vicia faba* L., treated with various plant growth regulators.**—*Canad. Ent.* **91** no. 8 pp. 527–528, 3 refs. Ottawa, 1959.

In investigations on the effect of plant-growth regulators on insect populations [*cf. R.A.E.*, A **38** 129, 342], four test materials were applied in solution to vermiculite in which plants of broad bean (*Vicia faba*), 1–3 in. high, were growing and absorption allowed to proceed for 48 hours. After a further 48 hours, an apterous summer vivipara of *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris) was placed on one of the two lowest leaves on each plant, the leaf was enclosed in dialysing tubing, and observations were made for the next five days. Neither mortality nor fecundity was affected by 2,4-D (defined as 2,4-dichlorophenoxyacetic acid 50 per cent. amine) at 0·01–2 parts per million, 2,4,5-T (defined as 2,4,5-trichlorophenoxyacetic acid 42·5 per cent. ester) at 0·0001–0·1 p.p.m., or MCPA (defined as 2-methyl-4-chlorophenoxyacetic acid 50 per cent. amine) at 0·1–8 p.p.m., but 40 per cent. soluble maleic hydrazide at 2,000–4,000 p.p.m. greatly reduced fecundity and caused high nymphal mortality at all rates, and at the highest rate also killed many of the adults; few nymphs on plants treated with it survived beyond the first instar, and many were born dead.

Brown (C. E.). **Reproduction of the pine needle scale, *Phenacaspis pinifoliae* (Fitch), (Homoptera: Diaspididae).**—*Canad. Ent.* **91** no. 9 pp. 529–535, 2 figs., 11 refs. Ottawa, 1959.

The following is based almost entirely on the author's summary. A review of the literature shows that dioecious sexual reproduction, obligatory parthenogenetic reproduction, dioecious sexual reproduction with facultative parthenogenetic reproduction in the absence of males and hermaphroditic reproduction all occur in Coccids. Coccids with normal dioecious reproduction usually have a sex ratio of 1 : 1 and in some species unfertilised females lay no eggs and produce abnormal scales [*cf. R.A.E.*, A **36** 342].

Observation of the mating habits of *Phenacaspis pinifoliae* (Fitch) on various conifers in Canada failed to show any strong sexual response by the females to the presence of males, which searched rapidly up and down the needles, passing over many females. They did not appear to have any means of orientating themselves for pairing when a suitable female was found. The sex ratio of *P. pinifoliae* was approximately 1 : 1 in the populations examined. An initial experiment in 1950 designed to provide data on the composition of the progeny of unmated females showed no consistent trends indicating an unusual number of either sex. The results of further experiments in 1950 and 1951 were inconclusive, but gave some evidence that fertilisation was necessary. In a final experiment in 1957, young nymphs established on small pines in pots were kept outdoors in an

uninfested area until the sexes could be distinguished, when the plants were brought indoors and the males, most of the needles and, on selected sample twigs, all the needles not bearing females were removed. The sample twigs were subsequently kept for about two weeks, but no eggs were laid. It therefore appears that reproduction in *P. pinifoliae* is sexual and dioecious and that unfertilised females do not oviposit; the unfertilised females produced distorted scales and survived for considerably longer than fertilised ones.

Buckner (C. H.). **Mortality of cocoons of the larch sawfly, *Pristiphora erichsonii* (Htg.), in relation to distance from small-mammal tunnels.**—*Canad. Ent.* **91** no. 9 pp. 535–542, 6 figs., 7 refs. Ottawa, 1959.

The relation between the fate of cocoons of *Pristiphora erichsonii* (Htg.) and distance from small-mammal tunnels was studied in 1958 in plots of larch in a forest reserve in eastern Manitoba. The following is substantially the author's summary. Small-mammal tunnels were very abundant in the bogs studied. Entrance holes to the surface occurred at intervals of about 6 in. Five subterranean chambers were found, and they all contained cocoons of *P. erichsonii*. Small-mammal predators usually destroyed over 50 per cent. of the cocoons. Mortality due to them was lowest in an area where *Blarina brevicauda* was the predominant predator and highest where *Sorex cinereus* was predominant. Most of the cocoons were destroyed within an inch of the tunnels. At 3 in. from them, the mammals almost ceased to be a mortality factor. The evidence suggests that small mammals reject cocoons containing dead or parasitised larvae. The percentage of cocoons containing dead larvae was low in the tunnels, high in areas close to them, and lower again in areas more remote. The percentage of successful emergence of the parasite, *Ptychomyia selecta* (Mg.) (*Bessa harveyi* (Tns.)) showed a similar trend where *Clethrionomys gapperi* and *Sorex cinereus* were abundant. Both these had previously been shown to reject parasitised cocoons [*cf. R.A.E.*, A **45** 321; **48** 142]. No relation was found between the percentage of successful emergence of *P. selecta* and the distance from tunnels in areas where *Sorex arcticus* and *Blarina brevicauda* predominated. Both these predators failed in previous experiments to discriminate between healthy and parasitised cocoons [*cf.* **45** 321; **48** 142]. Except in one area, small-mammal predation was found to be independent of the depth of the cocoons. Most Dipterous puparia had not been opened, indicating that they are unpalatable to most mammalian predators. Successful emergence by *P. selecta* was highest on the drier sites. In wet areas, the percentage emergence was lower as the limnic peat was approached.

Wong (H. R.), Drouin (J. A.) & McLeod (B. B.). **Observations on a "complex" of insects in tops of black spruce in Manitoba and Saskatchewan.**—*Canad. Ent.* **91** no. 9 pp. 543–548, 6 figs., 1 map, 6 refs. Ottawa, 1959.

Stands of black spruce (*Picea mariana*) in northern Manitoba and Saskatchewan were heavily defoliated by insects in 1954 and 1955. The most important species concerned was *Acleris variana* (Fern.), larvae of which were found at all crown levels. This Tortricid declined in 1956, after which reddening of the foliage was no longer noticeable, but other insects remained common in the tops of trees with dense, compact foliage in the upper crowns, such as is often found in the "club-top" condition of this tree.

The commonest, in order of decreasing frequency, were *Herculia thymetusalis* (Wlk.), *Archippus alberta* (McD.), *Recurvaria* sp., *Dioryctria abietivorella* (Grote) [*cf. R.A.E.*, A **48** 137] and *Epizeuxis americalis* (Gn.), and a field key for the separation of the larvae of these is given; *Gerdana caritella* Busck. and *Enarmonia* (*Zeiraphera*) *fortunana* (Kearfott) were less frequent. The insects occurred in a characteristic mass of dense foliage, cones and larval webbing in which were large quantities of frass, dried needles and parts of damaged cones. Feeding damage was cumulative from year to year, but the amount caused by each species could not be assessed.

In larval collections in 1955 and 1956, *H. thymetusalis* was more than twice as numerous as *A. alberta*. The larvae overwinter, probably in several instars, in silken cocoons among the frass and old needles and feed before and after on old and, as they become available, young needles; bud scales and the outer surface of young cones are also attacked. Larvae of *A. alberta* feed in shelters made by webbing young needles together and apparently overwinter in mined needles. *Recurvaria* sp. was responsible for most of the mined needles, and its numbers were probably underestimated. In the laboratory, the larvae fed on foliage of the current year and overwintered in mined needles; needle-mining and the webbing together of damaged needles, frass and pieces of bud scales are continued in spring. *D. abietivorella* was not numerous, but caused conspicuous damage by feeding within and superficially on the young cones, damaging both seeds and scales. The larvae occasionally fed on the needles in the laboratory. In September and October, they construct silken cocoons, in which they overwinter. *E. americalis* overwinters in the larval stage and, when feeding is resumed in spring, mainly attacks the old foliage.

Sampling at five places in Saskatchewan and four in Manitoba in 1956 showed that the insects, defoliation and cone damage were all confined to the topmost 3 ft. of the crown and that damage was heaviest on trees with "club-top" crowns, least in trees with conical open crowns, and of intermediate severity in trees with slender crowns. There is no evidence that infestation causes the "club-top" condition, which is apparently due to tree vigour and, in a five-acre plot, was more frequent in a swamp than on sloping ground or on a ridge. The association of insects was found as far north as latitude 57° in Manitoba and 59° in Saskatchewan in 1954 and 1955 and subsequently as far as latitude 61° in the Northwest Territories.

Hobbs (G. A.), Nummi (W. O.) & Virostek (J. F.). **History of the alfalfa weevil, *Hypera postica* (Gyll.) (Coleoptera: Curculionidae), in Alberta.** —*Canad. Ent.* **91** no. 9 pp. 562–565, 7 refs. Ottawa, 1959.

Hypera variabilis (Hbst.) (*postica* (Gylh.)) was recorded in Canada for the first time in June 1954, when the weevil was found in very small numbers in lucerne fields in south-eastern Alberta. Its specific parasite, *Bathyplectes curculionis* (Thoms.), emerged from some of the larvae, and it is concluded that the weevil, which had probably spread from the irrigated area along the Milk River in Montana had been present for at least a year. The number of infested lucerne fields increased from a few in the area south of the Oldman and South Saskatchewan rivers in 1955 to all those examined in the irrigated areas of southern Alberta in 1958, and the greatest increase occurred in 1958; damage was inconspicuous. The observations indicated that the adults become active late in the spring; overwintered individuals were more abundant on 3rd June than on 10th May 1957, though the lucerne was already 8 in. high on the earlier date, and no larvae were collected on 10th May 1957 or 22nd May 1958. Larval numbers reached a

peak between 17th June and 2nd July, and fourth-instar larvae predominated during the last week of June and in early July. In 1958, parasitism by *B. curculionis* reached a maximum of 53 per cent. and was highest in the larvae that hatched earliest [*cf. R.A.E.*, A **32** 11]. A partial second generation of parasites emerged in July from about 10 per cent. of the cocoons formed by larvae collected on 5th and 16th June.

PUTMAN (W. L.) & HERNE (D. C.). **Gross effects of some pesticides on populations of phytophagous mites in Ontario peach orchards and their economic implications.**—*Canad. Ent.* **91** no. 9 pp. 567–579, 2 graphs, 23 refs. Ottawa, 1959.

Studies on the indirect effects on populations of injurious arthropods of spray materials used for the control of pests on peach in the Niagara Peninsula of Ontario have been in progress since 1946, and an account is here given of the gross changes in mite populations produced by the sprays, their economic importance, and the possibility of reducing their injurious effects [*cf.* also *R.A.E.*, A **46** 190, etc.]. The materials tested were DDT, parathion and two fungicides, sulphur and captan, all in wettable formulations, and the following is based on the authors' summary of the results. DDT sprays promoted severe annual infestations of *Panonychus ulmi* (Koch) and more sporadic ones of *Tetranychus telarius* (L.) and *T. canadensis* (McG.). Numbers of a mite of the complex *Bryobia praetiosa* Koch identified by Morgan & Anderson as the species described by them as *B. arborea* [**47** 118] were increased to a less extent. *P. ulmi* developed strains resistant to parathion and became more troublesome than before this insecticide was used. Sulphur sprays generally promoted increases of *P. ulmi*, but these were not always serious. Sulphur was very toxic to *B. arborea* and *Aculus* (*Vasates*) *cornutus* (Banks). Captan showed no tendency to promote infestations of any species of mite. Mites would evidently not be troublesome if DDT, parathion and sulphur were omitted from the spray schedule, but the first two are needed for the control of *Cydia* (*Grapholitha*) *molesta* (Busck).

WRESSELL (H. B.) & WISHART (G.). **Note on occurrence of** *Horogenes punctorius* **(Roman) (Hymenoptera: Ichneumonidae), a parasite of the European corn borer,** *Ostrinia nubilalis* **(Hbn.) (Lepidoptera: Pyralidae), in southwestern Ontario.**—*Canad. Ent.* **91** no. 9 pp. 579–580, 2 refs. Ottawa, 1959.

Adults reared from Hymenopterous pupae found associated with dead larvae of *Ostrinia nubilalis* (Hb.) in south-western Ontario in 1957 proved to be *Angitia* (*Horogenes*) *punctoria* Roman, an introduced Ichneumonid parasite that was not hitherto known to be established in Canada, though over 2,000 adults were released in two districts of south-western Ontario in 1930 and 215 in 1934 [*cf. R.A.E.*, A **22** 302]. Four pupae were found at widely scattered places in 1957 and nine in 1958, and in early September 1958, when, in plant-resistance trials, six maize plants that had been artificially infested with 100 newly hatched larvae of *O. nubilalis* in each of 31 rows were dissected, 52 examples of the parasite were found, as well as 37 of *Lydella* sp., eight of *Eulophus* sp. and 483 host larvae. Although it is known that *A. punctoria* can maintain itself at a very low level of abundance, it is considered unlikely that it remained undetected since 1934. In Ohio,

where it was released in 1928 [*cf.* **39** 105], it was present at a low level in 1951 but was well established by 1955, and the average parasitism due to it there was stated to have increased to 11·5 per cent. in 1957. In view of its ability to cover great distances, it is probable that it entered Ontario by flight from Ohio.

Brown (N. R.) & Clark (R. C.). **Studies of predators of the balsam woolly aphid, *Adelges piceae* (Ratz.) (Homoptera: Adelgidae). VI. *Aphidecta obliterata* (L.) (Coleoptera: Coccinellidae), an introduced predator in eastern Canada.**—*Canad. Ent.* **91** no. 9 pp. 596–599, 8 refs. Ottawa, 1959.

The following is based almost entirely on the authors' summary of this part of a series dealing with predators of *Chermes* (*Adelges*) *piceae* Ratz. on balsam fir (*Abies balsamea*) in eastern Canada [*cf. R.A.E.*, A **48** 68]. Adults of the introduced Coccinellid, *Aphidecta obliterata* (L.), were released at Fredericton in 1941 and in five years between 1951 and 1957, and at two other places in New Brunswick in 1955. Releases were made in Newfoundland in 1957 and 1958. When liberations were made early in the summer, a complete generation was observed in the field during the same year. Recoveries were not made in any locality in the year following release, even where adults had been observed late in the previous summer, prior to hibernation. The failure of the predator to become established is attributed to the inability of the adults to survive winter conditions.

Thomson (H. M.). **A Microsporidian infection in the jack-pine budworm, *Choristoneura pinus* Free.**—*Canad. J. Zool.* **37** no. 2 pp. 117–120, 1 pl., 1 fig., 4 refs. Ottawa, 1959.

The following is taken from the author's abstract. A Microsporidian parasite of *Choristoneura pinus* Freeman in Canada is described and found to be very similar to *Perezia fumiferanae*, which attacks *C. fumiferana* (Clem.) [*cf. R.A.E.*, A **44** 290; **48** 139]. The differences between the two are not considered great enough to justify the creation of a new species; however, with the continued isolation of the two hosts [*cf.* **42** 220], the differences may become greater.

Mutchmor (J. A.) & Beckel (W. E.). **Some factors affecting diapause in the European corn borer, *Ostrinia nubilalis* (Hbn.) (Lepidoptera: Pyralidae).**—*Canad. J. Zool.* **37** no. 2 pp. 161–168, 3 graphs, 11 refs. Ottawa, 1959.

The following is virtually the authors' abstract. At 65°F., the percentage of larvae of *Ostrinia nubilalis* (Hb.) entering diapause in the laboratory increased from practically 0 to 95 as the photoperiod was increased from 0 to 9·5–14 hours of light per day, and decreased sharply to a minimum of 3 as photoperiod was increased to 16 or more hours of light per day. Rearing and studies on oxygen consumption revealed that, to be most effective, exposure to factors inducing diapause must begin before the second day of the final instar, and at 65°F. must continue for a period equivalent to the duration of the final instar. Exposure during any single instar but the last was not effective in inducing diapause.

Rose (A. H.). **The effect of defoliation on foliage production and radial growth of quaking aspen.**—*For. Sci.* **4** no. 4 pp. 335–342, 4 figs., 10 refs. Washington, D.C., 1958.

During investigations in north-western Ontario in 1950–53, it was observed that complete defoliation of quaking aspen (*Populus tremuloides*) by *Malacosoma disstria* Hb. caused the cessation of radial growth for the year, even though refoliation occurred, whereas any degree of incomplete defoliation merely reduced the rate of growth for the remainder of the season.

Kinghorn (J. M.) & Chapman (J. A.). **The overwintering of the ambrosia beetle** *Trypodendron lineatum* (**Oliv.**).—*For. Sci.* **5** no. 1 pp. 81–92, 6 figs., 14 refs. Washington, D.C., 1959.

The following is based on the authors' summary. Examination of litter from the forest floor in Vancouver Island showed that *Trypodendron lineatum* (Ol.) leaves the logs in which it has developed and overwinters in ground litter [*cf. R.A.E.*, A **47** 505]. More than two-thirds of the beetles penetrate to a depth of not more than 0·5 in., a few doing so under brood logs, when these are in clearings, but most in neighbouring forest. The density of hibernating beetles increases from the margin to a maximum 200 ft. or more within the forest; most apparently shelter within a few hundred feet of the edge, although some have been recovered over 1,000 ft. from their probable source. At any given distance, most occur at the base of the trees, but the thickness of the litter appears to be the important factor.

In a given locality, differences in ground cover appear to influence the number of beetles entering the litter. Although most are in hibernation by the end of August, some beetles continue to seek shelter until October. The exodus of the beetles from the litter in early spring coincides with spring flights and warm weather [*cf. loc. cit.*]. The movement of beetles in the litter may begin earlier and at a slightly lower temperature than flight.

The significance of the forest margin in relation to hibernation is discussed. The relatively greater exposure and lower moisture content of litter close to the edge of a stand is probably responsible for the lower densities of beetles there. Inwards from the boundary and beyond the zone of highest density, the distribution apparently falls off in accordance with a fundamental pattern of insect dispersal from a centre of infestation.

Spencer (G. J.). **The insects attacking structural timbers and furniture in homes in coastal British Columbia.**—*Proc. ent. Soc. B.C.* **55** pp. 8–13, 5 refs. Kamloops, B.C., 1958.

Notes are given on the local distribution and habits of the insects destructive to timbers and furniture in buildings in the coastal districts of British Columbia. The most widely occurring are termites, of which *Zootermopsis angusticollis* (Hagen) is the commonest, followed by carpenter ants (*Camponotus herculeanus* var. *modoc* Wheeler) and various Coleoptera, including *Anobium punctatum* (Deg.).

Zuk (P.). **Distribution of stored food insects in British Columbia.**—*Proc. ent. Soc. B.C.* **55** pp. 13–16, 9 refs. Kamloops, B.C., 1958.

A list is given of 35 species of insects found infesting stored cereals in towns in British Columbia in 1952–58. They did not include *Trogoderma*

granarium Everts, which has not appeared in the Province and is unlikely to become established there because of the unsuitable climate [*cf. R.A.E.*, A **46** 237].

Pielou (D. P.) & Downing (R. S.). **Trithion as an orchard insecticide.**—*Proc. ent. Soc. B.C.* **55** pp. 17–23, 6 refs. Kamloops, B.C., 1958.

Trithion has been found effective in sprays against many insects and mites on fruit trees in British Columbia, but caused severe scorching in one year.

Grant (J.). **Observations on a pine shoot moth, *Eucosma sonomana* Kft. (Lepidoptera: Olethreutidae).**—*Proc. ent. Soc. B.C.* **55** pp. 26–27, 1 ref. Kamloops, B.C., 1958.

Eucosma sonomana Kearfott is a minor pest of ponderosa and lodgepole pines [*Pinus ponderosa* and *P. contorta*] in the south of British Columbia. On ponderosa pine, the eggs are believed to be laid in early spring on the growing tips, and the larvae bore into the centre of the shoot and drop to the ground to pupate; the pupae overwinter [*cf. R.A.E.*, A **38** 185]. The damage caused to the trees is described.

Ross (D. A.). **A list of cone and seed insects of interior British Columbia.**—*Proc. ent. Soc. B.C.* **55** pp. 30–31. Kamloops, B.C., 1958.

The list given shows the insects reared from the cones and seeds of ten species of coniferous trees in the interior of British Columbia in 1950–55, with indication of those of economic importance.

Ruppel (D. H.). **A brief history of the larch sawfly, *Pristiphora erichsonii* (Htg.), in British Columbia.**—*Proc. ent. Soc. B.C.* **55** pp. 32–35, 2 figs., 2 refs. Kamloops, B.C., 1958.

Pristiphora erichsonii (Htg.), which was observed in British Columbia for the first time in 1930, has spread over the entire range of western larch (*Larix occidentalis*) in the south-east since 1933 [*cf. R.A.E.*, A **32** 175]. In 1952–54, it was observed on eastern larch (*L. laricina*) in scattered localities. No tree mortality was caused at any time. The course of the infestations is reviewed year by year, and it is stated that the population fell to a very low level in 1957, the last year considered.

Hedlin (A. F.). **Insects causing seed losses in Douglas fir on Vancouver Island in 1957.**—*Proc. ent. Soc. B.C.* **55** pp. 37–39, 3 refs. Kamloops, B.C., 1958.

Observations begun in Vancouver Island in 1957 showed that the insects responsible for losses of seed of Douglas fir [*Pseudotsuga menziesii*] comprised *Megastigmus spermotrophus* Wachtl, *Barbara colfaxiana* (Kearfott) and other cone moths and unidentified Cecidomyiids, which were the most injurious. Notes on their habits are given.

Janjua (N. A.) & Khan (M. A.). **Toxicity trials with reduced dosages of aldrin against desert locust hoppers in Pakistan.**—*Agric. Pakist.* **10** no. 3 pp. 333–337, 3 refs. Karachi, 1959.

Experiments were carried out near Hyderabad (Pakistan) during the 1953 spring breeding of the desert locust [*Schistocerca gregaria* (Forsk.)] to find the minimum effective dose of aldrin in wet and dry baits against the hoppers. The toxicant was used at 30 cc. of a 60 per cent. non-emulsifiable concentrate, 30 cc. of a 60 per cent. emulsifiable concentrate or 2 or 3 oz. of a 40 per cent. wettable powder per 100 lb. rice husks and gave complete mortality of first- and second-instar hoppers in all instances in about 30 hours. The dry bait of 2 oz. 40 per cent. wettable powder gave 85 per cent. kill in 10 hours.

Latif (A.), Qayyum (A.) & Piracha (M. A.). **Maize stem borer (*Chilo zonellus* Swin.) and its control.**—*Agric. Pakist.* **11** no. 1 pp. 25–36. 9 refs. Karachi, 1960.

Chilo zonellus (Swinh.) is a serious pest of maize in West Pakistan and damages up to 75 per cent. of some crops. The adults appear in March and April, and the females lay eggs in clusters of about 20 on the leaves. The larvae hatch in 3–6 days, feed for 15–30 days in the stems or on the leaves, cobs and ripening grains, and then pupate. Winter is passed in the larval stage in the stubble and cobs. In 1957–58, experiments were carried out on the control of this Pyralid. Plots were sprayed with endrin, trichlorphon (Dipterex) and diazinon at 0·25, 0·5 and 1 lb. per acre, respectively, either three times at intervals of two weeks or twice at an interval of three weeks. The percentage of plants injured in plots that received three applications was 2·2, 2·38 and 2·71 for endrin, trichlorphon and diazinon, respectively, as compared with 9·5 in the control. Plots receiving only two applications showed 3·54, 3·7 and 5·32 per cent. damage, respectively, as compared with 9·76 per cent. in the control. All treatments were significantly better than none, and three applications significantly better than two. When three applications were made, the increases in yield were 109·8, 101·9 and 94·7 per cent. for the three insecticides, respectively.

Alam (Z.) & Islam (A.). **Biology of the rice leaf hopper *Nephotettix bipunctatus* Fabre in East Pakistan.**—*Pakist. J. sci. Res.* **11** no. 1 pp. 20–28, 6 figs., 33 refs. Lahore, 1959.

Nephotettix apicalis (Motsch.) (*bipunctatus* (F.)) caused severe injury to rice in East Pakistan for the first time in 1956. The food-plants and distribution of this Cicadellid are reviewed, all stages are described and an account is given of observations on its bionomics in 1956–57. The females laid their eggs in the inner surface of the leaf-sheaths in groups of 3–18, after a preoviposition period of 6–9 days, and the nymphs hatched in 3–5 days and fed on the leaves and leaf-sheaths. The nymphal stage lasted 12–21 days, and the adults lived for 7–22 days in summer and were very active, feeding and moving from plant to plant. There were six overlapping generations a year, beginning in March, and the adults overwintered. The eggs were attacked by two unidentified parasites and a fungus, *Spicaria* (*Nomuraea*) sp. Both nymphs and adults were destroyed by *Coccinella arcuata* F. and the adults also by lizards and toads. The population was greatest in summer, but was reduced by heavy rain.

Nirula (K. K.). **Investigations on the pests of the coconut palm. Part V.** *Leucopholis concophora* **Burm.**—*Indian Cocon. J.* **12** no. 1 pp. 10–34, 2 pls., 20 refs. Ernakulam, 1958.

The following is based on part of the author's summary of this account of the bionomics and control of *Leucopholis concophora* Burm., a serious pest of coconut known only from Travancore-Cochin and North Malabar, some of the information in which has already been noticed [*R.A.E.*, A **43** 295]. The eggs of the Melolonthid, all stages of which are described, are laid in the soil near grass roots or decaying organic matter in June–August and hatch in about 20 days. The larvae feed on the roots of coconut [*cf. loc. cit.*] and other plants until the following April or early May and pupate in cocoons constructed deep in the soil. The adults emerge after 2–3 weeks, but remain in the soil for some time; emergence from the soil occurs simultaneously in widely separated areas, usually in June, about a fortnight after the start of the south-west monsoon. The adults survived for a month in the laboratory, but are thought to live for about eight weeks in the field. They are not attracted to light or affected by light rain or wind, and were not observed to feed. Mating and oviposition are described. Their powers of flight are weak, and infestations do not normally spread, but during severe outbreaks there is a slow dispersal by means of short flights. No parasites were observed, but birds destroy many of the larvae and dogs and cats large numbers of the adults. In preliminary trials, a BHC dust containing 1·3 per cent. γ isomer, applied to the soil at 56 lb. per acre, and a wettable BHC spray containing 6·5 per cent. γ isomer, applied at 28 and 56 lb. per acre, were effective in controlling the larvae and did not differ significantly from each other. The BHC dust was also effective when mixed with an equal quantity of a 10 per cent. DDT dust, but the latter alone was of no value.

Mukerji (G. P.). **Some aspects of the biology of** *Bagrada picta* **Fabr.**—*Agra Univ. J. Res.* (Sci.) **7** pt. 2 pp. 143–156, 1 pl., 11 refs. Agra, 1958.

In 1956, studies were begun in Uttar Pradesh on the bionomics of *Bagrada cruciferarum* Kirk. (*picta* (F.)), a common pest of cruciferous vegetables in India. Earlier literature is reviewed, and all stages are described in some detail. The Pentatomid was reared on cabbage, and it was found that the eggs were laid usually singly and on the lower surface of the leaves. Females in the field and laboratory laid 103–129 and 41–130 eggs each, respectively. During oviposition, which occupied six days, some female mortality occurred. The nymphs hatched in 6–8 days in the field and 8–10 days in the laboratory, and they passed through five instars totalling about 21 days.

Judenko (E.). **The appearance of adult shot-hole borers (*Xyleborus fornicatus* Eich.) outside their galleries under natural conditions.**—*Tea Quart.* **29** pt. 2 pp. 104–111, 3 pls., 2 refs. Talawakelle, 1958.

As little is known of the behaviour of the adults of *Xyleborus fornicatus* Eichh. outside their galleries in tea bushes in Ceylon [*cf. R.A.E.*, A **47** 469], investigations were carried out in 1956–57 in which the beetles were shaken from the branches or captured on them by means of sticky bands. The results showed that there was no correlation between beetle numbers, the amount of rainfall and the age of the tea from pruning, that females appeared outside the galleries more often than males, and that some beetles appeared outside their galleries on the lower parts of the bush. Sticky traps were also used to investigate the distribution of the beetles in the air. Females

were taken at heights up to about 11–14 ft., so that it would be possible for them to reach fresh clearings from a neighbouring tea field, and the majority flew above the level of the tea bushes. Again, there was no obvious correlation between the numbers caught, rainfall and the age of the bushes from pruning.

JUDENKO (E.). **A note on the distribution of the entrances to the open galleries made by shot-hole borer** (*Xyleborus fornicatus* **Eich.) on tea.**—*Tea Quart.* **29** pt. 2 pp. 112–114, 1 ref. Talawakelle, 1958.

Investigations in 1957 on the distribution of galleries made by *Xyleborus fornicatus* Eichh. on tea bushes in Ceylon showed that most entrances were situated on the lower parts, so that most of the beetles appear, at least for some time, in that region [*cf.* also preceding abstract] and control might be achieved by sprays of contact insecticide applied to the lower parts only.

JUDENKO (E.). **Preliminary small-scale field experiments on a chemical method for the prevention of shot-hole borer** (*Xyleborus fornicatus* **Eich.) attack on tea in plucking.**—*Tea Quart.* **29** pt. 2 pp. 115–124, 2 pls., 1 fldg. table, 11 refs. Talawakelle, 1958.

In tests in Ceylon in 1957 on the value of emulsion sprays of 3·75 per cent. chlordane or 0·5 per cent. dieldrin applied to the lower parts of tea bushes for the control of *Xyleborus fornicatus* Eichh. [*cf.* preceding abstract], there was no difference in the effectiveness of sprays applied at heights of 6 or 12 in. to bushes 3 ft. high, and sprays applied 14–20 months after pruning caused considerable reductions in the numbers of living adults 2·5–9 months after treatment. The sprays caused no injury to the bushes. The rates of application were 110 gal. per acre at the 6-in. height and 245 gal. at 1 ft.

RANAWEERA (D. J. W.). **Acaricidal trials against the scarlet mite,** *Brevipalpus australis* **Tucker, on tea.**—*Tea Quart.* **29** pt. 2 pp. 125–128, 2 refs. Talawakelle, 1958.

Weekly applications of light and heavy sprays (15 and 150 gal. per acre) of chlorobenzilate for the control of *Brevipalpus californicus* (Banks) (*australis* (Tucker)) on tea in Ceylon were continued beyond the four already noticed [*R.A.E.*, A **45** 416]. Eight applications of the heavy spray to the undersides of the leaves proved effective, but 14 of the light one applied from above still left appreciable numbers of living mites. In a further test, chlorobenzilate was incorporated in the light sprays of Perenox [cuprous oxide] used to control blister blight and compared with a heavy spray of sulphur applied four times at fortnightly intervals, both programmes beginning four weeks after pruning, when infestation was heavy. The light sprays effected some reduction in mite numbers, but not so much as the heavy ones, up to six months from pruning, but the population then increased and was about the same as on the untreated bushes by 15 months after pruning. There was no general defoliation for up to 20 months, and no differences in yield at that time.

EASTEAL (P. R. U.). **Some notes on scarlet mites and longer pruning cycles.**—*Tea Quart.* **29** pt. 2 pp. 129–131. Talawakelle, 1958.

Infestation of tea in Ceylon by the scarlet mite, *Brevipalpus californicus* (Banks) (*australis* (Tucker)), has increased of recent years, especially where

long pruning cycles are adopted. The mites are removed by normal pruning, but the shade trees should be pollarded also if reinfestation is to be prevented [*cf. R.A.E.*, A **45** 416]. Sulphur is effective for control, but taints the tea, so that plucking must be postponed for three weeks; high-volume sprays are better than dusts.

Liu (Siu-king). **Life history and control of the citrus leaf roller** (*Adoxophyes cyrtosema* **Meyr.) in Canton China.** [*In Chinese.*]—*Acta ent. sin.* **8** no. 4 pp. 293–316. 4 pls., 5 figs., 28 refs. [Peking] 1958. (With a summary in English.)

One of the most important pests of *Citrus* and litchi (*Litchi chinensis*) in Canton and the east of Kwangtung Province is *Adoxophyes cyrtosema* Meyr., the larvae of which cause serious damage to the young fruits, flowers, leaves and buds, causing young *Citrus* fruits to drop in April–May. The eggs are laid in masses on both surfaces of the leaves, and, in the insectary, they hatched in an average of 7·2 days. The larvae web leaves together to form nests, in which they feed, and the larval stage lasted 14–50 days. The pupal stage lasted 4–27 days and was passed in the last larval nest or in a thin cocoon between two webbed leaves. The adults are phototrophic, and they lived for 2–22 days. Winter is passed in the larval or more rarely the pupal or adult stages. The generations overlap in the field, and nine occurred in the year in the insectary.

The larvae are parasitised by unidentified Braconids, and the pupae by *Brachymeria obscurata* (Wlk.), *Phaeogenes* sp. and *Nemorilla maculosa* (Mg.). *Xanthandrus comtus* (Harris) and *Callida* sp. prey on the larvae. In preliminary experiments with emulsion sprays, 0·05 per cent. parathion (E605) gave 82–97 per cent. mortality of larvae, and though late-instar larvae were less susceptible than younger ones, 0·25–0·5 per cent. DDD was very effective against them. DDT was less effective, and BHC ineffective alone, but a combination of the two gave fair control, and a spray containing 0·1 and 0·06 per cent. of them, respectively, or the parathion spray, applied in April and May at five-day intervals, is recommended. Sprays containing 0·125 per cent. DDT of 0·06 per cent. BHC used alone gave complete control of adults, and were effective against moths confined in a cage 30 minutes after it had been sprayed. Other control recommendations comprised orchard sanitation, hand-picking of egg-masses, and the use of light-traps during flowering and fruiting.

Tsai (Pang-hua), Liu (Yu-ch'iao), How (T'au-ch'ien), Li (Chih-yin) & Ho (Chung). **Preliminary study on the development of the pine caterpillar, *Dendrolimus punctatus* Walker, under different conditions of injury of the host plant.** [*In Chinese.*]—*Acta ent. sin.* **8** no. 4 pp. 327–334, 2 graphs, 3 refs. [Peking] 1958. (With a summary in English.)

In 1956, investigations were carried out in Hunan Province on the relation of the degree of damage on *Pinus massoniana* to the density of infestation of it by *Dendrolimus punctatus* (Wlk.) [*cf. R.A.E.*, A **47** 78]. Pupae were collected from trees damaged to different degrees, and measurements of the weight and length of the pupae and the length, wing-span and egg-production of the resulting females were made. The measurements showed that pupae from the less damaged trees were heavier and resulted in a higher proportion of females and greater egg-production than those from the more damaged ones; that pupae of the overwintering generation were larger and heavier

than those of the first (although more eggs were produced by females of the latter); and that the number of eggs was directly proportional to the weight of the pupae of the preceding generation. In a test, nearly full-fed larvae of the overwintering generation were prevented from feeding at varying times, and it was found that the earlier the cessation of feeding, the higher the mortality (except in the case of larvae of the last instar), the lower the pupal weight and the lower the percentage of females. Field observations showed that there are 2–3 generations a year, the third occurring mostly on the less densely infested trees.

Sutardi Mangundojo (R. G.). **Penjelidikan mengenai penggerek polong** *Crotalaria juncea* **L. di Djawa . . . Investigations concerning pod borers infesting** *Crotalaria juncea* **L. in Java.**—*Contr. gen. agric. Res. Sta. Bogor* no. 152, [3+] 101 pp., 4 pls., 8 graphs, 37 refs. Bogor, 1958. (With a summary in English.)

In Java, the yield of seed of *Crotalaria juncea* is severely reduced by insects that bore in the pods. Investigations showed that *Etiella zinckenella* (Treitschke) and two Arctiids, *Utetheisa lotrix* (Cram.) and *Argina cribraria* (Cl.), were the most injurious, pod infestations by the first averaging 31·9 per cent. at one place and ranging from 13·2 to 67·9 per cent. at others, and that by the other two reaching 50 per cent. in favourable conditions. The females of *Etiella* laid an average of 73 eggs each under the calyx lobes of developed pods, and those of the others laid about 500 each on the leaves; larvae of *Etiella* fed in several pods each and those of the others fed on both leaves and pods. The pupal stage was passed in the ground. The egg, larval, prepupal and pupal stages lasted 4, 16, 3, and 12 days, respectively, for *Etiella*, 3, 18, 2 and 6 days for *Utetheisa*, and 3, 18, 2 and 8 days for *Argina*. Two generations of any of these could be expected between the time of pod formation and harvest. Subsidiary damage is caused by the Lycaenid, *Cosmolyce* (*Lampides*) *boetica* (L.), notes on which are also given. Control by field sanitation is considered impracticable, as too many alternative food-plants exist. *Argina* and *Utetheisa* were attacked by *Entomophthora* (*Empusa*) *grylli*, though this fungus was effective only during long wet periods, and by five predacious insects, which are rare. *Etiella* was parasitised by ten species of Hymenoptera, but only *Phanerotoma hendecasiella* Cam. was of importance; it attacked 18·1 per cent. of the larvae. The Arctiids were likewise parasitised by Hymenoptera, and *Argina* also by Tachinids; the most important was *Telenomus procas* Nixon, which attacked the eggs of both species and afforded an average of 89·8 per cent. parasitism of those of *Argina*. Since it has no very effective parasite, the population density of *Etiella* is related to the frequency of rain, and it is thought that suitable areas for the cultivation of *C. juncea* are those where the average daily rainfall is low enough to prevent the development of large numbers of *Etiella* but not too low to discourage the parasites of the Arctiids.

Wallace (M. M. H.). **Insecticides for the control of the lucerne flea,** *Sminthurus viridis* **(L.), and the red-legged earth mite,** *Halotydeus destructor* **(Tuck.), and their effects on population numbers.**—*Aust. J. agric. Res.* **10** no. 2 pp. 160–170, 4 graphs, 14 refs. Melbourne, 1959.

The following is largely the author's summary. Experiments carried out in Western Australia in 1953–55 demonstrated the effectiveness of low-volume insecticide sprays for the control of *Sminthurus viridis* (L.) and

Halotydeus destructor (Tucker) in pastures [*cf. R.A.E.*, A **43** 411]. As dual-purpose insecticides, mixtures of 0·5 oz. malathion with 1 oz. DDT or γ BHC (as lindane) per acre and 1 or 2 oz. endrin per acre all gave excellent results. The relatively low cost and low mammalian toxicity of malathion and DDT favour this mixture, which is now recommended for field use [**46** 31]. Dieldrin at 4 oz. and Chlorthion and diazinon, both at 0·5 and 1 oz. per acre, were effective against *S. viridis*; γ BHC at 1 and 2 oz. and Dilan [a 1:2 mixture of Prolan and Bulan] at 3·5 and 7 oz. per acre gave good control of *H. destructor*, but DDT at 4 oz. was superior to both. None of the materials used against *S. viridis* had an effective residual action, so that careful attention to the time of application was essential. Treatment within 3–5 weeks of the rains that initiate hatching of the aestivating eggs is recommended. Eradication was not achieved by any of the treatments, and their subsequent effects on population density are discussed. The numerical changes suggested that density-governing factors play an important part in regulating the numbers of both species.

Browning (T. O.). **The long-tailed mealybug, *Pseudococcus adonidum* (L.), in South Australia.**—*Aust. J. agric. Res.* **10** no. 3 pp. 322–339, 1 graph, 5 refs. Melbourne, 1959.

The following is based almost entirely on the author's summary of this account of investigations on the seasonal history of *Pseudococcus adonidum* (L.) on irrigated orange trees in South Australia. The numbers of the mealybug rise in a fairly regular sequence throughout the year. They are always low in summer (December–March), rise in autumn (April–June) and early winter (July), and fall gradually in late winter (August) and spring (September–November). There is a sudden sharp rise in November, followed almost at once by an equally sharp fall to the numbers characteristic of summer. Food seems to play no part in this sequence, except as its quality may influence behaviour. During summer, most of the mealybugs on the leaves are to be found in specially sheltered places, such as under spiders' webs, where the humidity is greater than elsewhere. Young mealybugs on hatching are active in summer, tend to leave the shelter in which they originate and are likely to perish before they find another suitable place. As autumn approaches, the weather becomes cooler and less desiccating, and although the reproductive rate may fall, the chance that young mealybugs will survive increases. This continues until winter cold reduces the reproductive rate to the point where it can no longer compensate for deaths, and the population falls. At the same time, predacious insects become more numerous and take a greater toll of the population, forcing numbers still lower. In early spring, the insects stop feeding and seek a sheltered place in which to reproduce. The migration from the leaves to the trunk and ground increases during September and October until the numbers left on the leaves are very low. At this time, predacious insects become still more numerous and the numbers of sheltering mealybugs may be greatly reduced. In November, a new generation invades the leaves, but most of the mealybugs are killed by the hot dry winds that are common at this time of the year. The population falls to a low level and remains so until autumn.

Given (B. B.). **Biological control factors influencing populations of oak leaf-miner, *Lithocolletis messaniella* Zeller, in New Zealand including the introduction of parasites.**—*N.Z. J. agric. Res.* **2** no. 1 pp. 124–133, 6 graphs, 4 refs. Wellington, N.Z., 1959.

Lithocolletis messaniella Zell., which has spread rapidly in New Zealand since 1951 [*cf. R.A.E.*, A **43** 363], is now present there throughout almost

all areas where suitable broad-leaved trees occur and attacks species outside its normal range [*cf.* **43** 234; **48** 338]. In view of its potential importance and the impracticability of applying chemical measures to trees such as oaks, attempts were made to control it by introduced parasites. It develops 6–7 generations a year, and the life-cycle requires a minimum of about 32 days in summer. Populations reach high peaks in late spring and autumn, followed in each case by a sudden drop due to heavy mortality and then by a gradual increase. The autumn mortality is associated with reduced sap flow in the leaves of the deciduous summer food-plants, chiefly oaks, and is especially high in the leaves of *Quercus robur*, on which no larvae survive after the end of March. It is accompanied by a transference of oviposition from deciduous trees to evergreen ones such as *Q. suber* and *Q. ilex* [*cf.* **48** 338]; the leaves of these differ from the deciduous ones in having hairs on the lower surface, and the intensity of oviposition is proportional to the degree of hairiness. The fall in numbers in late spring is less marked and is brought about by the drying of the leaves of *Q. suber*, which, however, can maintain populations throughout the year, and to a proliferation of parenchyma that kills the larvae within the mines on *Q. ilex*. Autumn mortality is very high among young larvae but negligible among older ones, and most of the eggs laid by the females to which the latter give rise in late January and early February are laid on deciduous trees. The continuance of the species therefore depends on the presence of evergreens.

Two parasites were introduced in 1957 and liberated in the Nelson district, *Apanteles circumscriptus* (Nees) from Italy and *Enaysma splendens* Delucchi from Switzerland [*cf.* **48** 339]. Adults of the first were confined in autumn on the leaves on infested evergreen oaks in 42 cages, each containing 10–15 females, for 4–5 days, after which the cages were removed. First-instar larvae of *Lithocolletis* were not attacked, but in several cages almost all the second-instar larvae were parasitised. The maximum parasitism of all larvae in the cages was over 50 per cent. and was just as high for cages containing females only as for those containing also males; pairing was not observed, and parthenogenetic reproduction is considered to be normal. The Braconid spread satisfactorily during the winter and spring of 1957 and reached high populations in the summer. The drop in host numbers in autumn appears critical for its establishment, but since it continues to attack the low larval populations on *Q. suber* as well as the high ones on deciduous trees, it is likely to survive, though it may not exert control. Its dependence for survival on winter host populations may necessitate the planting of *Q. suber* in districts from which this tree is absent. A species of *Pnigalio*, identical with a European one and active only in summer, occurs on deciduous oaks and was present with *A. circumscriptus* in leaf samples of *Q. robur* in January 1958. Its effectiveness as a parasite was evidently reduced by *A. circumscriptus*, but the evidence indicates that the two together can exert control. *E. splendens* was liberated in summer, mostly on *Q. cerris*, and parasitism of 42 per cent. was later recorded in a leaf sample from one cage. This Eulophid undergoes a winter diapause in fallen leaves, and those from the tree on which most of the liberations were made were distributed in another plantation, where observations on its establishment were to be made in the summer of 1958–59.

Manson (D. C. M.). **Insects and mites associated with ryegrass.**—*N.Z. J. agric. Res.* **2** no. 1 pp. 169–173, 10 refs. Wellington, N.Z., 1959.

A survey of the arthropod fauna of pastures of rye-grass [*Lolium perenne*] was made in four fields in the North Island of New Zealand between

October 1956 and January 1957. The numbers of insects and mites found are given, and their fluctuations are briefly discussed. Those of most economic importance were *Hyperodes griseus* Hust. [*cf. R.A.E.*, A **27** 547; **48** 371], which is widespread throughout much of New Zealand and damages newly sown pastures and also various crops, and *Cerodontha denticornis* (Mg.) [*cf.* **27** 548], an Agromyzid that sometimes becomes sufficiently numerous to cause injury.

Palmer-Jones (T.). **Effect on honey bees of Thiodan applied to broad beans in a cage.**—*N.Z. J. agric. Res.* **2** no. 2 pp. 229–233, 1 graph, 5 refs. Wellington, N.Z., 1959.

Palmer-Jones (T.), Forster (I. W.) & Jeffery (G. L.). **Effect on honey bees of Rogor and endothion applied from the air as sprays to brassicas; trial of M.G.K. repellent 874.**—*T.c.* no. 3 pp. 475–480, 2 graphs, 5 refs. **Effect on honey bees of DDT and Thiodan applied from the air as sprays to chou moellier.**—*T.c.* pp. 481–487, 2 graphs, 5 refs.

The following paragraphs are based on the authors' summaries of these three papers, respectively, which contain accounts of work in New Zealand on the effect of insecticides on honey bees.

In a cage test, flowering plants of broad bean (*Vicia faba*) were treated with an emulsion spray of 1 per cent. Thiodan at a rate equivalent to 56 gal. per acre and bees were allowed access after an hour. The spray repelled the bees for three hours but caused no mortality among them, although they collected nectar when repellency ceased.

Turnips in flower were sprayed from the air with dimethoate as a proprietary preparation (Rogor 40) containing 40 per cent. (w/v) active ingredient, which was applied at 16 fl. oz. in 7 gal. water per acre to two acres of a seed-crop, and rape in flower with a 0·33 per cent. aqueous solution of endothion, of which 30 gal. was applied also over two acres; the dimethoate spray included 8 oz. of an emulsion concentrate containing 50 per cent. M.G.K. repellent 874 (a recently developed bee repellent). Both sprays were applied in the early morning, and neither repelled the bees that subsequently visited the crops. Dimethoate proved highly toxic to the bees, though the brood was not affected, but endothion caused no mortality. Endothion also had little effect on *Brevicoryne brassicae* (L.) infesting the rape, although it was stated to kill this aphid in Britain quite readily when applied from the ground at 0·02–0·04 per cent. and a rate of 100 gal. per acre.

Two flowering crops of marrow-stem kale (chou moellier) in flower were sprayed early in the day, one with an emulsion spray of 2 lb. p,p'DDT in 7 gal. water per acre and the other with an emulsion spray of 1·2 lb. Thiodan in 7 gal. water. Honey bees were repelled by the DDT for six days after application, but there was no evidence that it affected bumble bees (mostly *Bombus terrestris* (L.)). Some mortality occurred among the honey bees, though not enough to weaken the hives, and the brood was unaffected. Thiodan showed no repellency and was more lethal than DDT to the honey bees. Although no adverse effect on adult bees or brood was observed in the apiary, it is considered that the hives would have been seriously affected if an area of more than one acre had been sprayed, and this material should therefore not be applied to cruciferous crops in flower.

Close (R.). **Sticky traps for winged aphids.**—*N.Z. J. agric. Res.* **2** no. 2 pp. 375–379, 1 fig., 3 refs. Wellington, N.Z., 1959.

Modifications of the yellow cylindrical adhesive traps designed for studies of winged aphids [*R.A.E.*, A **37** 365] were developed in New Zealand to

facilitate their operation with a minimum of alteration in widely separated areas. The metal traps were painted with zinc chromate primer and covered with cellulose-acetate film. Cup grease was the best of three adhesives tested. It was easy to apply and remove, effective in trapping aphids, and not affected by high temperatures or, to any serious extent, by heavy rain. Aphids were readily detected on it and could be removed in the field.

Hamblyn (C. J.). **Army caterpillar damage on East Coast hill country.**—*N.Z. J. Agric.* **98** no. 4 pp. 329, 331–333, 7 col. figs. Wellington, N.Z., 1959.

In the autumns of 1956 and 1957, armyworms, probably *Pseudaletia separata* (Wlk.) and *Persectania aversa* (Wlk.) [*cf. R.A.E.*, A **43** 123], defoliated over 120,000 acres of rough hill pasture on the east coast of North Island, New Zealand, leaving the damaged areas bare and exposed to invasion by weeds. Grasses were preferred and clover avoided. The pastures did not recover in the summer of 1957–58, which was dry, and much feed was lost. Adults of these Noctuids pair soon after emergence in late spring and early summer, and the females lay about 500 eggs each. Oviposition takes place in sunlit, rough pasture, where there is ample protection for the eggs and larvae. The larvae remain on the sunny slopes and feed, mainly at night, on leaves and stems, moving to uninfested areas as they develop. In a favourable summer, there are 2–3 generations. Sprays of 1·5 pints 15 per cent. dieldrin or 2 pints 20 per cent. DDT in 5–10 gal. water per acre, applied from aircraft, killed the larvae, but they were not applied until the damage had been done. Prevention of injury depends on spraying groups of young larvae as soon as they are detected in summer.

Banks (C. J.) & Nixon (H. L.). **Effects of the ant, *Lasius niger* L., on the feeding and excretion of the bean aphid, *Aphis fabae* Scop.**—*J. exp. Biol.* **35** no. 4 pp. 703–711, 1 fig., 18 refs. London, 1958.

The following is based on the authors' summary. To test the view of J. Herzig in a paper previously noticed [*R.A.E.*, A **26** 195] that the excretion and feeding rates of aphids are stimulated by attendant ants [*cf.* **47** 47], plants of broad bean (*Vicia faba*), on which groups of nymphs of *Aphis fabae* Scop. were feeding, were made radioactive with ^{32}P in water culture, so that the aphids took up the isotope and excreted it in their honeydew. The radioactivity of the honeydew taken from them by attendant ants, *Lasius niger* (L.), was then compared with that of the honeydew excreted concurrently by unattended aphids on separate plants. By increasing their uptake of sap, the ant-attended aphids produced twice as much radioactivity in their excreta as did the ant-free aphids. The aphids directly control their rates of excretion and feeding, which are not determined solely by forces within the plant [*cf.* **48** 414]. The aphid apparently controls its feeding by the 'sucking pump' (a dilatation of the anterior part of the gut lying between the proximal end of the stylet food canal and the oesophagus) in its head. It is suggested that the pump is normally closed but that it opens periodically to admit sap and then closes ventrally to force the ingested sap into the stomach. During normal feeding, the pump probably opens and closes at regular intervals, but when the aphid is ant-attended, it could operate more frequently so as to force sap into the stomach more often. The uptake of sap by normally feeding aphids is apparently not continuous [*cf.* **48** 160].

Dunn (J. A.). **The survival in soil of apterae of the lettuce root aphid, *Pemphigus bursarius* (L.).**—*Ann. appl. Biol.* **47** no. 4 pp. 766–771, 2 graphs, 3 refs. London, 1959.

The following is based on the author's summary. Some aphids in populations of *Pemphigus bursarius* (L.) on the roots of lettuce or other summer food-plants do not form wings and fly back to poplar (*Populus*) [*cf. R.A.E.*, A **48** 351]. The fate of these apterae was investigated in the insectary and field in central England in 1956–57, and it was found that they could successfully overwinter although their original food-plant had died. Having overwintered without their food-plant, they were able to colonise the roots of spring-sown lettuce. Whether the soil was cultivated before or after winter seemed to have little effect. The influence of temperature on survival was studied in the insectary. The results indicated that 5 per cent. could survive for about 40 weeks at 40°F., and, since the mean soil temperature at a depth of 4 in. during winter (1st October to 1st April) in 1951–58 ranged from 39·1 to 41·7°F., it appears to be well within the capacity of *P. bursarius* to overwinter in the soil without a food-plant in the English midlands.

Dunn (J. A.). **The effect of temperature on reproduction by the alatae of *Pemphigus bursarius* (L.).**—*Ann. appl. Biol.* **47** no. 4 pp. 772–777, 5 graphs, 2 refs. London, 1959.

The following is almost entirely the author's summary. The reproductive rate of the alates of *Pemphigus bursarius* (L.) was studied at temperatures between 38 and 82°F. in the insectary. The fundatrigeniae showed the greatest total reproduction at about 60°F., but the highest reproductive rate at 70–81°F. The corresponding temperatures for the sexuparae were about 55 and 67°F. The average outdoor air temperatures prevailing in central England at the times when the respective winged forms are most abundant [*cf. R.A.E.*, A **48** 351] correspond closely to the temperatures required for maximum reproduction. On a basis of temperature, adult sexuparae trapped underground by unfavourable soil conditions can be expected to survive for about 12 days in early September and for about 30 days at the end of October.

Pollard (D. G.). **Feeding habits of the lace-bug *Urentius aegyptiacus* Bergevin (Hemiptera: Tingidae).**—*Ann. appl. Biol.* **47** no. 4 pp. 778–782, 7 figs., 5 refs. London, 1959.

The following is virtually the author's summary. Adults and nymphs of the Tingid, *Urentius aegyptiacus* de Berg., feed on the leaves of egg-plant (*Solanum melongena*) in the northern Sudan. Their stylets are of typical Hemipterous structure and are inserted into the leaf from either surface. Penetration of the epidermis is mainly intracellular, but may be intercellular or stomatal, while the course through the mesophyll and palisade tissues—frequently in a plane parallel to the leaf surfaces—is predominantly intracellular. The stylets terminate intracellularly, generally within a palisade cell, sometimes in a mesophyll cell, but only rarely in the vascular elements. The stylet sheath and track are absent, and the saliva neither gells nor stains. Feeding damage, which results in externally visible chlorotic areas, is caused by the extraction of cell contents within feeding zones, which are confined at first to the palisade but later extend to the mesophyll:

it is accompanied by laceration of the cell walls and diffusion of an oral secretion of low phytotoxicity. Shrinkage of the leaf is due initially to collapse of the mesophyll and epithelial cells; the palisade and xylem cells retain their characteristic size and shape until destruction of the other tissues is complete.

WAY (M. J.). **Experiments on the mode of action of insecticidal seed-dressings, especially against** *Leptohylemyia coarctata* **Fall., Muscidae, the wheat bulb fly.**—*Ann. appl. Biol.* **47** no. 4 pp. 783–801, 4 figs., 23 refs. London, 1959. **Experiments on the mode of action of dieldrin seed-dressings against seedling attack by the larval frit fly,** *Oscinella frit* **L.**—*T.c.* pp. 802–808, 5 refs.

The following paragraphs are based on the author's summaries of the work described, which was carried out in England.

Dieldrin, aldrin and γ BHC, applied as seed dressings to wheat, proved able to kill larvae of *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) either by contact or by systemic action [*cf. R.A.E.*, A **44** 261]. Newly hatched larvae may be killed by contact action when they pass close to the treated seed on their way to attack the shoot. Such kill depends on their behaviour and the depth at which the seed is sown. Larvae move upwards after hatching and probably reach the surface soil where they search for the food-plant, entering the shoot at a depth of 0·25–1 in. This behaviour explains the results of experiments in which about half the larvae were killed by contact action of dieldrin on seeds sown 0·25 in. deep and few or none by similarly treated seeds sown at a depth of 3 in. It is not known whether the larvae are killed directly by contact action or whether they die of starvation after being deterred. Larvae not killed by contact may be killed by systemic action. The systemic action of dieldrin and aldrin, unlike their contact action, does not protect the plant from damage by the larvae, which tunnel within the shoot and destroy the growing point before they are killed; γ BHC applied as a seed dressing apparently remains systemically active for less time than dieldrin or aldrin, but while active usually kills, or perhaps deters, the larva before it significantly damages the plant. The uptake of dieldrin and aldrin by the wheat seedling depends on contact between the insecticide and the seed or roots, close contact with the seed seeming especially important [*cf.* **48** 445]. Systemic action is also favoured by late and by very shallow sowing and by increasing the dose of insecticide adhering to the seed. Dieldrin applied as a seed dressing at 4·5 mg. per seed was not phytotoxic to wheat of the test variety sown within ten days of treatment, whereas γ BHC, even at 0·022 mg. per seed, delayed the germination of some seeds. Preliminary experiments with dieldrin seed dressings against larvae of *H.* (*Delia*) *antiqua* (Mg.) showed that newly hatched larvae mostly enter the young onion plant at the base of the bulb close to the position of the treated seed and are thus likely to be killed by contact with the insecticide on the seed. There was no evidence that dieldrin seed dressings act systemically against larvae of this species.

Experiments with dieldrin seed dressings were carried out to discover whether the conditions favouring their action against larvae of *H. coarctata* apply also to *Oscinella frit* (L.) [*cf.* **45** 233; **47** 223]. Experiments with oats and wheat in boxes and a small field trial with oats showed that fewer newly hatched larvae were killed when dieldrin-treated seed was sown at a depth of 2 in. than when it was sown at 0·25–0·5 in.; shallow sowing probably puts the insecticide where the larvae are likely to meet it before they attack the plant. Kill was never complete even

with dieldrin applied at almost 40 times the highest rate normally used. This is partly because some larvae hatch from eggs on the plant, and these, unlike those from eggs in the soil, enter the shoot without touching the seed dressing. Even in the most favourable circumstances (large doses of dieldrin on shallow-sown seed and the plant at the one-leaf stage) there was little evidence that the larvae are killed inside the shoot by systemic action. This is not because the pales that normally surround the oat seed impair the uptake of insecticide, or because of any other factor specific to oats. Larvae of *O. frit* also survived in wheat from seed dressed with doses of dieldrin that can kill almost all larvae of *H. coarctata* by systemic action. Possible reasons for the difference are discussed.

D'Aguilar (J.). **Remarques préliminaires sur la pullulation d'une mineuse des feuilles de pommier** (*Stigmella malella* **SH.) dans la région parisienne.**—*C. R. Acad. Agric. Fr.* **45** no. 5 pp. 213–215, 7 refs. Paris, 1959.

The first serious damage to apple by *Stigmella malella* (Stnt.) was reported in the Paris region in 1954. Further outbreaks occurred in 1956 and 1957, and the moth was studied at Versailles in 1958. The adults emerged in the second half of April and May, and the females oviposited a few days later on the lower leaf surfaces. The larvae hatched in 6–7 days and mined the leaves; when full-fed they dropped to the ground and pupated among dead leaves. First-generation adults emerged during July. There were two overlapping generations a year, with some indication of a third, and winter is passed in the cocoon. Trees treated with insecticides once a fortnight in spring were heavily infested, apparently because *Cirrospilus vittatus* Wlk., a parasite of the larvae, had been destroyed; parasitism reached 80–90 per cent. and infestation was less severe on less frequently sprayed trees. Control is made difficult by overlapping of the generations, oviposition on the underside of the leaves and the inaccessibility of the larvae. Insecticide dusts applied to the ground against adults of the overwintering generation and orchard sanitation to destroy pupae are recommended for control.

Toumanoff (C.) & Toumanoff (Christiane). **Les épizooties dues à** *Serratia marcescens* **Bizio chez un termite** (*Reticulotermes santonnensis* **de Feytaud).**—*C. R. Acad. Agric. Fr.* **45** no. 5 pp. 216–218, 2 refs. Paris, 1959.

Examples of *Reticulitermes lucifugus* subsp. *santonensis* Feytaud from a large colony in discarded wood at a timber yard in Rochefort-sur-Mer showed signs of disease when examined in November 1958. The symptoms and the characteristics of a strain of bacteria isolated from the insects are described. It was concluded that the agent was *Serratia marcescens* [*cf. R.A.E.*, A **48** 359].

van der Want (J. P. H.) & Bos (L.). **Geelnervigheid, een virusziekte van luzerne.** [Vein yellowing, a virus disease of lucerne.]—*Tijdschr. PlZiekt.* **65** pt. 3 pp. 73–78, 1 pl., 1 fig., 4 refs. Wageningen, 1959. (With a summary in English.)

A virus disease referred to as vein yellowing is prevalent on lucerne in Holland. It was found to be caused by the tip-yellows (leaf-roll) virus of pea, and was transmitted in tests from pea to lucerne by *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris).

Bos (L.), Delević (B.) & van der Want (J. P. H.). **Investigations on white clover mosaic virus.**—*Tijdschr. PlZiekt.* **65** pt. 3 pp. 89–106, 4 pls., 10 refs. Wageningen, 1959. (With a summary in Dutch.)

An account is given of studies on four isolates of a virus found in white clover (*Trifolium repens*) in Holland. It was transmitted by contact and by dodder, but not by three species of aphids, including *Myzus persicae* (Sulz.), even after a long starvation period and short infection feeding periods.

Helle (W.). **Het voorkomen van resistentie tegen organische fosforverbindingen bij de bonespintmijt** (*Tetranychus urticae*) **in Aalsmeer.** [The occurrence of resistance to organic phosphorus compounds in *T. telarius* at Aalsmeer.]—*Tijdschr. PlZiekt.* **65** pt. 3 pp. 107–115, 5 figs., 11 refs. Wageningen, 1959. (With a summary in English.)

The following is based on the author's summary. The susceptibility to acaricides of several populations of *Tetranychus telarius* (L.) (*urticae* Koch) occurring in nurseries at a place in Holland was investigated in 1958 by transferring batches of 50 adult females to plants treated with the various compounds. Of 22 populations from glasshouses, 20 showed resistance to parathion, diazinon and demeton, that to demeton being very variable, but all were susceptible to Kelthane and chlorobenzilate. No resistance was apparent in populations on weeds outside the houses. In further tests, mites from populations resistant to the three organophosphorus compounds also proved resistant to several others to which they had never been exposed before.

van Hoof (H. A.). **The Delphacid** *Sogata cubana* **vector of a virus of** *Echinochloa colonum*.—*Tijdschr. PlZiekt.* **65** pt. 5 pp. 188–189, 2 refs. Wageningen, 1959. (With a summary in Dutch.)

It has been suggested that the wild hosts of the virus that causes the hoja blanca disease of rice are grasses. In Nickerie, Dutch Guiana, *Echinochloa colonum* is common in and round rice-fields and almost always shows symptoms resembling those of hoja blanca, although the rice does not. This may be due to a difference in the virus concerned or to a difference in the vectors on grass and on rice. The vector from rice to rice has been shown elsewhere to be *Sogata orizicola* Muir [*cf. R.A.E.*, A **47** 31], but no transmission from grass to grass or rice has been reported. In June 1959, *S. orizicola* was rare on rice at Nickerie, but *S. cubana* (Crawford) was taken on neighbouring diseased grasses. Examples reared from eggs on the latter readily infected healthy *Echinochloa* seedlings, but *S. cubana* from infected *E. colonum* did not infect rice seedlings. Non-infected examples of *S. cubana* reared on *Leptochloa scabra* caused no symptoms on healthy seedlings of *E. colonum*, so that the disease of *Echinochloa* is apparently not due to an insect toxin.

Evenhuis (H. H.). **Effect van insekticiden op de bloedluisparasiet** *Aphelinus mali*. [The effect of insecticides on *A. mali*, the parasite of *Eriosoma lanigerum*.]—*Meded. Dir. Tuinb.* **22** no. 6 pp. 306–311, 2 figs., 3 refs. The Hague, 1959. (With a summary in English.)

In experiments in Holland, apple twigs bearing mummified bodies of *Eriosoma lanigerum* (Hsm.) containing developmental stages of *Aphelinus*

mali (Hald.) were collected and sprayed in the laboratory with various insecticides. DDT, BHC, diazinon and Thiodan had little effect on the parasites, whereas parathion and malathion severely reduced parasite emergence; the fully grown larvae in diapause were not affected, but late pupal stages were killed.

Rygg (T.). **Bønneflue et lite kjent, men viktig skadedyr.** [The bean fly, a little known but important pest.]—*Gartneryrket* **48** no. 12 pp. 219–220, 2 figs. Oslo, 1958. (With a summary in English.)

Bean seedlings have of recent years been severely injured by *Hylemyia trichodactyla* (Rond.) in southern and south-eastern Norway. Tests with insecticides in seed dressings in 1956 and 1957 gave promising control, powders containing 40 per cent. aldrin or 50 per cent. dieldrin, used at about 1·5 per cent. by weight of the seed, being the best.

Eisenschmidt (H.). **Ein starkes Auftreten der Buckelfliege *Megaselia rufipes* Meigen (Diptera, Phoridae) als Parasit des Kartoffelkäfers (*Leptinotarsa decemlineata* Say) im Jahre 1956.** [An important occurrence of *M. rufipes* as a parasite of *L. decemlineata* in 1956.]—*Z. angew. Zool.* **45** pt. 1 pp. 11–19, 10 refs. Berlin, 1958. (With a summary in English.)

The following is based on the author's summary. When newly emerged adults of *Leptinotarsa decemlineata* (Say) collected in 70 localities in eastern Germany in August–September 1956 were kept in the laboratory, examples from 16 localities were found to be parasitised by *Megaselia rufipes* (Mg.), the percentages ranging from 0·22 to 19·05 and averaging 3·24.

Lergenmüller (E.). **Ökologische Untersuchungen am Getreideplattkäfer *Oryzaephilus surinamensis* L.** [Ecological investigations on *O. surinamensis*.]—*Z. angew. Zool.* **45** pt. 1 pp. 31–97, 20 figs., 66 refs. Berlin, 1958. (With a summary in English.)

Detailed investigations were carried out in the laboratory in Germany on the development of *Oryzaephilus surinamensis* (L.) at various temperatures and relative humidities [*cf. R.A.E.*, A **44** 410, etc.]. This Cucujid is a pest of stored products, and there is no record of its occurrence outdoors in that country. The female reproductive organs and the method of oviposition are described. The Cucujid was reared in rolled oats, the immature stages usually at 70–80 per cent. relative humidity. The eggs developed at temperatures between 14–16°C. [57·2–60·8°F.] and 36–38°C. [96·8–100·4°F.]; the shortest duration of development without high mortality (3 days) occurred at 32°C. [89·6°F.] and the longest (17·5 days) at 16°C. Relative humidities of 60–80 per cent. resulted in the lowest egg mortality. Exposure of eggs laid at 28°C. [82·4°F.] to 4 and 8°C. [39·2 and 46·4°F.] for 4 and 10–12 days, respectively, killed all of them, but shorter exposures did not and the survivors developed normally when transferred to 32°C. The larvae were cannibalistic when deprived of their normal food, but did not survive on animal food alone. The average duration of larval development ranged from 14·9 days at 32°C. to 70·2 days at 18°C. [64·4°F.] and 21·9 days at 38°C., at which mortality was high, and the rate of development

increased with relative humidity. Exposure of larvae hatching from eggs that had developed at 32°C. to 4 and 8°C. for 4–5 and 8–10 days, respectively, killed most or all of them, and none of the survivors completed their development when returned to 32°C. The average duration of pupal development ranged from 4·4 days at 36°C. to 24·5 days at 18°C., and was little affected by relative humidity, and that of total development from 18–35 days at 32°C. to 85–129 days at 18°C. The average number of eggs laid per female per day at 65–75 per cent. relative humidity was highest at 28–32°C., at which it ranged from 0·82 to 0·44, and was very low at the extreme temperatures. At 60–70 per cent. relative humidity, starved adults all died in periods ranging from 63 days at 16°C. to 8 days at 38°C. About two-thirds of the adults were killed by exposure to 8°C. for two months and almost all of them by exposure to 4°C. for 20 days or to a temperature of just under 0°C. [32°F.] for two days. The fertility of females surviving shorter periods at 4°C. and of some of those doing so at 0°C. was apparently not impaired. Adults kept at 45°C. died rapidly. Temperatures of 32–34°C. and medium or lower relative humidities were preferred.

Niklas (O. F.). **Entwicklung und Rickettsiose-Auftreten bei Larven vom Maikäfer** (*Melolontha* **spec.) im Freiland und im Laboratorium.** [Development and infection with rickettsiosis of larvae of *Melolontha* in the field and laboratory.]—*Z. angew. Zool.* **45** pt. 1 pp. 103–116, 3 figs., 7 refs. Berlin, 1958. (With a summary in English.)

The course of infection in field and laboratory populations of *Melolontha* sp. having the disease caused by *Rickettsiella* (*Rickettsia*) *melolonthae* is discussed from investigations on mortality factors carried out in western Germany in 1954–57 [*cf. R.A.E.*, A **48** 82, etc.]. The results largely substantiated those already noticed [**46** 290–291].

Gösswald (K.). **Zum Wirkungsmechanismus von Thiodan.** [On the mode of action of Thiodan.]—*Z. angew. Zool.* **45** pt. 2 pp. 129–151, 5 figs., 13 refs. Berlin, 1958.

Thiodan has been reported to be toxic to numerous insects [*cf. R.A.E.*, A **48** 96, etc.]. In the laboratory investigations here described, the effectiveness of a 20 per cent. emulsion concentrate against nymphs of *Kalotermes flavicollis* (F.) was tested. Prolonged contact with deposits from the concentrate on filter paper increased the oxygen consumption of the termites, even after knockdown had occurred, and a specific effect on metabolism was inferred. When the concentrate was used at a dilution of 0·1 per cent., the speed of action increased with both temperature and relative humidity. At 100 per cent. relative humidity, mortality was complete after 5 hours at 37·8°C. [100°F.] and 150 hours at 12·4°C. [54·3°F.] and was 90 per cent. after 150 hours at 6·9°C. [44·4°F.], while at 17–20 per cent. relative humidity it was complete in 23 hours at 37·8°C. and 70 per cent. after 32 hours at 30·3 or 25·6°C. [86·5 or 78°F.] and after 150 hours at 17·2 or 6·9°C. [63 or 44·4°F.]. Histopathological investigations showed no effects of exposure to deposits of 0·1 or 1 per cent. of the concentrate for 24 hours, but changes in the thoracic ganglia were evident after 48 hours in termites exposed to 1 per cent. deposits. Tests in which worker ants (*Lasius niger* (L.)) fed each other with honey solution containing the concentrate labelled with ^{32}P, contact action being thereby eliminated so far as possible, showed that stomach toxicity was slight.

The remaining tests concerned the protective effect of Thiodan. In one series carried out at 98 per cent. relative humidity and 27°C. [80·6°F.], the termites were placed, without food, on filter papers soaked in the concentrate, dead individuals being continually replaced. Mortality four days after treatment with 0·1 or 0·2 per cent. dilutions of the concentrate was so high that the test was discontinued. Mortality was less rapid when the concentration was reduced to 0·05 per cent., and there was considerable feeding on the filter papers. Paper treated with 0·2 per cent. of the concentrate and weathered for 14 days was also eaten. Further tests in which contact with the treated paper was reduced confirmed the absence of any considerable stomach toxicity. When the termites were placed on 5 g. sand impregnated with 0·5 cc. insecticide, mortality was complete or almost complete in 3–4 days for 0·2–0·05 per cent. dilutions, but greater ones were much less effective. In a similar test, pieces of pine wood infested with termites were placed in 500 cc. soil impregnated with 30 cc. of a 0·2 per cent. dilution of the concentrate or 1 g. of a 0·2 per cent. Thiodan dust. Mortality was complete in three weeks.

Tests to determine the effect of exposure of the insecticide in sand to high temperatures together with either high or low relative humidities before exposing the insects to it were carried out in an apparatus (which is described) that provided a continual supply of fresh air. The termites were placed in dishes in such a way that their only access to pieces of untreated pine wood lay through the treated sand. When they were exposed to sand freshly impregnated with various amounts of 0·05–0·2 per cent. dilutions of the concentrate (in a relative humidity of 98 per cent.), all were dead in 5–6 days. When the treated sand was first exposed to a temperature of 60°C. [140°F.] and 40 per cent. relative humidity for 8 days and the insects then tested at the higher humidity and a normal temperature, the higher concentrations maintained their effectiveness, and the lower ones permitted a longer survival, though there was at most slight damage to the wood, and when the treated sand was first exposed to a temperature of 60°C. and a relative humidity of 95 per cent. for 8 days, or (for the 0·2 per cent. concentration) 12 weeks, and the insects tested as before, all or nearly all the termites were dead in 15–21 and 15–35 days, respectively.

Löcher (F. J.). **Der Einfluss von Dichlordiphenyltrichlormethylmethan (DDT) auf einige Tetranychiden (Acari, Tetranychidae).** [The effect of DDT on some Tetranychids.]—*Z. angew. Zool.* **45** pt. 2 pp. 201–248, 4 figs., 33 refs. Berlin, 1958. (With a summary in English.)

DDT has been reported to cause increases in populations of Tetranychid mites that were not due to elimination of their predators [*cf. R.A.E.*, A **39** 237; **43** 341; **45** 335–336], and tests were therefore carried out in Germany to determine its effect on the fertility of a greenhouse and a field form of *Tetranychus telarius* (L.) (*urticae* Koch) and on *Panonychus* (*Metatetranychus*) *ulmi* (Koch). The spray used was a 0·1 per cent. suspension of a preparation containing 80 per cent. DDT, and the following is based mainly on the author's summary of the results.

DDT had no effect on the duration of development, on mortality of the immature stages or on the length of adult life of the greenhouse form of *T. telarius*. Treatment of freshly emerged females of either species had no effect on the numbers of eggs laid by them, but females of the F_1 generation (untreated) showed increased egg-production, the percentage increase being 90 and 80 for the greenhouse and field forms of *T. telarius* and 70 for

P. ulmi. A few females of the F_2 generation also showed increased egg-production, but normal numbers were laid by the F_3 females. When spraying of the greenhouse form of *T. telarius* was continued for nine successive generations, the numbers of eggs laid remained about 90 per cent. above normal during treatment but returned to normal two generations after it. When eggs, larvae and nymphs in the first resting stage were sprayed, an increase in the number of eggs laid occurred in the females of the same generation, the number falling off sharply in the following one, and when treatment was applied to protonymphs or nymphs in the second resting stage, the increase occurred in the former case either in the same generation or in the next and in the latter case in the next. Similar results were obtained with *P. ulmi*. Stimulation of egg-production (for which contact with a treated surface for one minute sufficed) was shown to be due to direct action of the DDT on the mites, and not to stimulation of the plants, since it also occurred on filter paper. Much the same increase in numbers of eggs laid was obtained when adults of the greenhouse form of *T. telarius* were treated with the suspension diluted to contain as little as 0·001 per cent. of the DDT product, with an emulsion containing 0·06 or 0·0006 per cent. p,p′DDT (the equivalent of the suspension in p,p′isomer), or with a preparation of DDT and BHC, but not when they were treated with a suspension of BHC alone.

Field tests carried out in 1955 and 1956 on fruit trees infested by *P. ulmi* confirmed the stimulating effect of DDT on the mite population, increases being recorded on treated trees that were independent of those due to the destruction of natural enemies.

Schindler (U.). **Der mittlere schwarze Rüsselkäfer** (*Otiorrhynchus niger* **F.).** [The weevil *O. niger*.]—*Z. angew. Zool.* **45** pt. 3 pp. 257–313, 24 figs., 60 refs. Berlin, 1958. (With a summary in English.)

The following is based on the author's summary. *Otiorhynchus niger* (F.) attacks spruce (*Picea abies* (*excelsa*)) in many mountainous regions of Europe, and a detailed account is given of investigations on its bionomics in the western Harz mountains of Germany. A generation lasts two years, and the adults, which do not fly, live for 2–3 years. The latter feed on the needles and young shoots, causing little damage, but the larvae attack the roots and are very injurious in forest nurseries. The adult weevils are parasitised by a Tachinid, *Rondania dimidiata* (Mg.), and a Braconid, *Pygostolus multiarticulatus* (Ratz.). DDT sprays are effective against the adults, and soil treatment with BHC against the larvae.

Klink (G.). **Testung von Blattläusen auf der Drehscheibe, mit einem Befund über die statische Orientierung.** [Testing of aphids on the rotating disk, with a discovery about static orientation.]—*Z. angew. Zool.* **45** pt. 3 pp. 337–340, 1 fig., 2 refs. Berlin, 1958. (With a summary in English.)

An apparatus is described in which aphids are placed in open petri dishes, each of which covers the top of a revolving disk and contains a filter paper treated with insecticide, in order to test the effect of exposure to the latter over a period with elimination of fumigant action. When the disks revolve at a fairly high speed, the aphids remain in the dishes and move in the

opposite direction, at first concentrically and then slightly towards the centre, even in the dark.

Berker (J.) & Löcher (F. J.). **Untersuchungen über die Rübenmotte, *Phthorimaea ocellatella* Boyd (Lepidopt., Gelechiidae).** [Investigations on *P. ocellatella*.]—*Z. PflKrankh.* **66** pt. 2 pp. 65–76, 1 map, 19 refs. Stuttgart, 1959. (With a summary in English.)

Populations of *Gnorimoschema* (*Phthorimaea*) *ocellatella* (Boyd) have in the past become considerable on beet in warm, dry years in an area of western Germany including parts of Hesse and the Palatinate [*cf. R.A.E.*, A **24** 15, etc.], and damage was severe in 1952–53. The distribution of the moth in Europe and elsewhere is summarised from the literature. Investigations carried out in 1955–57 showed that the area infested was considerably greater than it had been when populations were high in 1934 and included, in addition, a part of Baden. The distribution of the infestation at the two dates is shown in a map. Fodder-beet was preferred to sugar-beet, and eggs were usually laid on the root collar or on dead leaf stalks and less frequently on the heart leaves or on the stalks of healthy leaves. The heart leaves were seldom destroyed, and the numbers of plants infested were generally low, probably owing to a return to normal weather conditions. There were three generations a year, but larvae of a further generation were observed in 1955, although they did not complete their development. Overwintering took place in the pupal stage. In the laboratory, the eggs developed in 6–7 days at 22–23°C. [71·6–73·4°F.], and the average duration of the larval stage ranged from 11·4 days at 30°C. [86°F.] to 20·2 days at 18·5°C. [65·3°F.]. The pupal stage averaged 10–13·5 days at 20·8–22·8°C. [69·44–73·04°F.]. Relative humidity had no effect on duration of development. The females laid averages of 69·6 eggs at 30°C. and 74·4 at 18·5°C., and the duration of adult life averaged 11·1 days at 18–22°C. [64·4–71·6°F.].

Quednau (W.). **Über eine Methode zur Messung von Biozönose-Einflüssen unter Verwendung von Eiparasiten der Gattung *Trichogramma* (Hym. Chalcididae).** [On a method of measuring biocoenotic influences during use of egg parasites of the genus *Trichogramma*.]—*Z. PflKrankh.* **66** pt. 2 pp. 77–86, 8 figs., 5 refs. Stuttgart, 1959. (With a summary in English.)

Investigations are described in which the influence of environmental factors on parasitism by species of the genus *Trichogramma* [*cf. R.A.E.*, A **46** 398–400] was studied quantitatively. The host eggs used were those of *Anagasta* (*Ephestia*) *kühniella* (Zell.). To allow these various biotic factors to exert their natural effect in a limited space, most of the tests were carried out in a tent that contained cabbage plants in pots, young apple trees or false paper plants of similar sizes, to which host eggs were attached. The adult parasites were then introduced into the tent. The temperature was kept at about 27°C. [80·6°F.], and the relative humidity was 40–60 per cent. In the tests with the tent, *T. cacoeciae* Marchal and *T. embryophagum* (Htg.) gave rise to much less parasitism and *T. minutum* Ril. to rather less parasitism of eggs on cabbage than did *T. evanescens* Westw. (the true cabbage form [*cf.* **46** 399]), *T. semblidis* (Auriv.) or *T. pretiosum* Ril. Parasitism by *T. evanescens* on cabbage reached saturation at a maximum of about 80 per cent., and that by *T. cacoeciae* at about 10 per

cent. *T. cacoeciae* parasitised eggs on apple more readily, and *T. evanescens* apparently less readily, than on cabbage. Host eggs on paper plants the size of cabbages were parasitised by *T. evanescens* to about the same extent as, and by *T. cacoeciae* to a greater extent than, those on cabbage, and parasitism by *T. evanescens* and *T. cacoeciae* was lower and that by *T. minutum* greater when the host eggs were on paper plants the size of the apple trees than when they were on the apple trees themselves. It is concluded that chemotactic influences on the one hand and thigmo- and geotactic influences on the other are responsible for the variations in behaviour. In tests in which adults of *T. evanescens* and *T. cacoeciae* were released into a climate chamber containing real or artificial cabbage plants, the results corroborated those obtained in the main tests.

Böhm (H.). **Zum Vorkommen der Mittelmeerfruchtfliege,** *Ceratitis capitata* **Wied., im Wiener Obstbaugebiet.** [The occurrence of the Mediterranean fruit-fly, *C. capitata*, in the fruit-growing region of Vienna.]—*Pflanzenschutzberichte* **21** pt. 9–10 pp. 129–158, 10 figs., 23 refs. Vienna, 1958. (With a summary in English.)

Ceratitis capitata (Wied.), which was found in Vienna in 1931 [*cf. R.A.E.*, A **20** 663], was observed there again in the late summer of 1952, when peaches were infested. It spread in the following years, but was checked by unfavourable weather in 1956 and there was again no increase in 1957. Peaches and apricots were the principal fruits attacked, but others were also infested. Investigations showed that the fruit-fly had two generations a year and overwintered as pupae. Winter mortality was 30 per cent. in normal winters but reached 87 per cent. in that of 1955–56, when a prolonged period of severe frost occurred in February. This was also unfavourable to peach and apricot, so that the fruit-fly population was still further affected, but the infestation was not eradicated. Tests showed that storage of infested fruits for a month at 0°C. [32°F.] killed all the immature stages, but that sprays of insecticide applied to the trees had little effect; DDT gave the best results and repelled the adults for a few hours after application. No natural enemies were observed.

Böhm (H.). **Ein Vorkommen der Noctuidenart** *Xylina* (*Calocampa*) *exoleta* **L. an Obstbäumen.** [An occurrence of the Noctuid species *X. exoleta* on fruit trees.]—*Pflanzenschutzberichte* **21** pt. 11–12 pp. 185–187, 3 figs., 3 refs. Vienna, 1958. (With a summary in English.)

In March 1958, eggs of *Xylena exoleta* (L.) were observed near the unopened buds on apple and apricot trees in and near Vienna. Larvae that hatched in the laboratory fed on the leaves and completed development. No previous record of the Noctuid on fruit trees is known.

Böhm (O.). **Zum Vertilgerkomplex von** *Taeniothrips simplex* **Mor.** [On the predator complex of *T. simplex*.]—*Pflanzenschutzberichte* **22** pt. 4–5 pp. 49–52, 13 refs. Vienna, 1959. (With a summary in English.)

Taeniothrips simplex (Morison), which was found on *Gladiolus* in Austria for the first time near Vienna in 1951, was very injurious for a few years, but then became much less so where chemical control was applied in summer

only or not at all. This was found to be due to attack by *Aeolothrips fasciatus* (L.) and to a less extent by *Orius* (*Triphleps*) *niger* Wolff.

Böhm (H.). *Argyresthia ephippella* **Fabr. und** *Argyresthia albistria* **Haw. als Pfirsichblütenschädlinge.** [*A. ephippella* and *A. albistria* as peach-blossom pests.]—*Pflanzenschutzberichte* **23** pt. 1–2 pp. 27–29, 4 figs., 2 refs. Vienna, 1959. (With a summary in English.)

In the spring of 1959, severe damage was caused to the blossom buds of peach by larvae of *Argyresthia ephippella* (F.) and *A. albistria* (Haw.) in the Austrian Province of Styria. They had not previously been recorded on this fruit tree.

Nagy (B.). **Kísérletek a szilvadarazsak kártételének elhárítására.** [Experiments on the control of plum sawflies.]—*Növénytermelés* **8** no. 2 pp. 157–175. 2 figs., 23 refs. Budapest, 1959. (With summaries in Russian & English.)

Experiments were carried out in Hungary in 1954–56 on the control of *Hoplocampa minuta* (Christ) and *H. flava* (L.) on plum, of which the former is by far the most important pest. The effectiveness of the sprays was determined from counts of all the fruits in 1954, but from counts of those still on the trees about three weeks after petal-fall in 1955–56. Of the insecticides tested, 0·02 per cent. parathion from an emulsion concentrate (Ekatox 20), 0·05 per cent. demeton (Systox) and 1–2 per cent. wettable BHC gave almost complete control and were more effective than quassia. Good results were obtained in preliminary tests with trichlorphon (Dipterex) and dieldrin, toxaphene was less effective but useful before petal-fall, as it is not harmful to bees, and a microcrystalline DDT paste, though comparatively ineffective, was better than other Hungarian DDT preparations. Sprays were best applied when the larvae were hatching, which occurred during the first ten days of May in 1955. Adults of *H. minuta* were more susceptible to parathion and BHC than to the other materials, and older larvae in the fruits were killed by parathion, probably owing to vapour action. One application was sufficient, except in wet weather or against a heavy infestation, and the yield was doubled or trebled if it was made at the right time.

Szilvássy (L.) & Petrasovits (I.). **A** *Hydrellia griseola* **Fall. 1959 évi magyarországi kártétele rizsen.** [On the damage in rice-fields caused by *H. griseola* in 1959.]—*Növénytermelés* **9** no. 2 pp. 171–174, 3 figs., 5 refs. Budapest, 1960. (With summaries in Russian & English.)

Hydrellia griseola (Fall.) was observed in large numbers on rice for the first time in Hungary in 1959, when it caused serious damage. It was first noticed in the deeper water. The cool, wet weather both inhibited the early development of the plants and encouraged the appearance of the pest. The larvae completed their development in 10–14 days in the leaves, and 1–3 and sometimes more larvae or pupae were found per leaf. Infested leaves turned yellow and became transparent, but shallow irrigation alternated with drainage, to prevent water deficit or excess sunlight, resulted in the recovery of a significant number of injured plants. Braconids of the genus *Opius* emerged from most of the pupae collected.

Juchnowicz (I.), Romankow (W.) & Ruszkowski (J.). **Wyniki badań nad biologią i zwalczaniem strąkowca bobowego—***Bruchus rufimanus* **Boh. (Coleoptera, Bruchidae). The results of the studies on the biology and control of broad-bean weevil—***Bruchus rufimanus* **Boh. (Coleoptera, Bruchidae).**—*Bull. ent. Pologne* **27** (1957) pp. 21–36, 10 figs., 12 refs. Wrocław, 1958. (With a summary in English.)

The following is based largely on the authors' summary. Studies on the bionomics and control of *Bruchus rufimanus* Boh. on broad bean [*Vicia faba*] were carried out in western Poland in 1951–54. Adults appeared in May and were most numerous when the plants were in full bloom. Oviposition lasted 5–6 weeks, beginning in June, and 1–55 eggs were found per pod. The egg and larval stages lasted 9–11 and about 40 days, respectively, and the pupal stage lasted 13 days in the laboratory and 15 in the field. Observations showed that 57–85 per cent. of the adults left the beans in autumn and overwintered in the bark of surrounding trees, the rest overwintering in the beans. The larvae showed up to 80 per cent. parasitism by the Braconid, *Triaspis similis* Szépl. In tests in 1952–54, fields were dusted with 8 per cent. BHC at 18 and 27 lb. per acre or 5 per cent. DDT at 27 lb. per acre, once at full bloom and again 8–9 days later. BHC caused a considerable reduction in the numbers of eggs and adults and in the damage done by the larvae; DDT was comparatively ineffective.

Kawecki (Z.). **Studia nad rodzajem** *Lecanium* **Burm. Część V. Misecznik miechun** *Lecanium coryli* **(L.)** *sensu* **Marchal** *nec* **Sulc. (Homoptera, Coccoidea, Lecaniidae). Studies on the genus** *Lecanium* **Burm. Part V. The nut or thorn scale** *Lecanium coryli* **(L.)** *sensu* **Marchal** *nec* **Sulc (Homoptera, Coccoidea, Lecaniidae).**—*Bull. ent. Pologne* **27** (1957) pp. 39–69, 2 pls., 7 figs., 4 pp. refs. Wrocław, 1958. (With a summary in English.)

In this part of a series [*cf. R.A.E.*, A **48** 404], all stages and the bionomics of *Eulecanium* (*Lecanium*) *coryli* (L.) are described and its nomenclature, world distribution, food-plants and parasites are reviewed. In Poland, it is recorded from 30 species of plants, notably plum, and its principal parasite is *Blastothrix sericea* (Dalm.). The pupae of the males are attacked by the fungus, *Cordyceps pistillariaeformis*.

Juchnowicz (I.) & Romankow (W.). **Wyniki badań nad biologią i znaczeniem gospodarczym paciornicy lucernianki** *Contarinia medicaginis* **Kieff. (Diptera, Cecidomyidae). The results of the studies on the biology and economic importance of** *Contarinia medicaginis* **Kieff. (Diptera, Cecidomyidae).**—*Bull. ent. Pologne* **28** pp. 35–58, 15 figs., 10 refs. Wrocław, 1958. (With a summary in English.)

In 1953–55, studies were carried out in western Poland on the bionomics of *Contarinia medicaginis* Kieff., which causes serious loss of lucerne seed. Adults of the overwintered generation appeared about mid-May and were most abundant in late June and early July; individuals of succeeding ones were most numerous in late July and early August and in late August, respectively. Oviposition continued for about two months, and 2–28 eggs were laid per pod. The larvae hatched in 3–5 days, fed for 11–12 days in the pods and then entered the soil, where they completed development and gave rise to adults 11–18 days later. The females, which contained 25–118 eggs each, lived for 1–4 days, and the males for 1–3. Winter was passed in larval cocoons in the upper 4 in. of soil.

Cmoluch (Z.). **Wstępne badania nad morfologią i biologią** *Baris coerulescens* **Scop. (Coleoptera, Curculionidae). Preliminary examination of the morphology and biology of** *Baris coerulescens* **Scop. (Coleoptera, Curculionidae).**—*Bull. ent. Pologne* **28** pp. 133–139, 9 figs., 4 refs. Wrocław, 1958. (With a summary in English.)

Preliminary studies were carried out in eastern Poland in 1954–55 on the bionomics of *Baris coerulescens* (Scop.), the larva and pupa of which are described. Eggs were laid in May in the stems of winter rape, and the larvae tunnelled to the root collar and pupated at the end of their mines. The larval and pupal stages lasted about six and two weeks, respectively, and the adult weevils emerged in the second half of August and the beginning of September and hibernated before leaving the plants. There was only one generation a year.

Romankow (W.). **Wyniki badań nad biologią ozdobnika lucernowca—** *Adelphocoris lineolatus* **Goeze (Heteroptera, Miridae), z uwzględnieniem niektórych momentów jego ekologii. The results of studies on the biology of** *Adelphocoris lineolatus* **Goeze (Heteroptera, Miridae), with reference to certain problems of its ecology.**—*Bull. ent. Pologne* **29** fasc. 1 pp. 55–105, 13 graphs, 22 refs. Wrocław, 1959. (With a summary in English.)

The results are given of studies carried out in 1952–56 on the bionomics of *Adelphocoris lineolatus* (Goeze), which causes serious losses of lucerne seed in Poland. Eggs were laid in the lucerne stems up to 2–3 in. above the soil and in the terminal parts of weeds in and round the fields. There were two generations a year. The overwintered eggs hatched in May–June, and the resulting nymphs completed their development in periods ranging from 21 days in 1956 to 42 in 1955. The adult females, which lived for about four weeks, laid an average of 80 eggs each in July or early August. These hatched in 12–26 days in 1955 and 20–32 in 1956, and the nymphs appeared in July–August and reached maturity in about a month. Overwintering eggs were laid in September at the average rate of 34 per female. Populations of 20 Mirids per 100 sweeps of the net caused minor damage to buds and flowers, populations of 120 caused distinct damage, and populations of 250 caused total loss of buds. Numbers were high in older fields, but fluctuated each year according to ecological conditions.

Kalandadze (L. P.) & Shavkatsishvili (L. D.). **Contributions to the study of several species of flies as pests of vegetables in Georgia.** [*In Russian.*] —*Soobshch. Akad. Nauk gruz. SSR* **21** no. 3 pp. 319–326, 15 refs. Tiflis 1958.

Notes are given on the distribution, and sometimes the bionomics, of 17 species of Diptera found infesting vegetables in the Georgian Republic in 1954–56. The most important were *Eumerus strigatus* (Fall.), *Phytobia* (*Dizygomyza*) *cepae* (Mg.) and *Hylemyia antiqua* (Mg.) on onion, the first being particularly injurious to young plants in spring; *H. brassicae* (Bch.) and *H. cilicrura* (Rond.) on cabbage, the former causing serious damage to spring cabbage and the latter also attacking cucumber; *Psila rosae* (F.), which was widespread on carrots in eastern districts; and *Pegomyia betae* (Curt.) (*hyoscyami*, auct.), which was common on sugar-beet.

Manolache (F.), Iacob (N.), Iacob (M.) & Tușa (C.). **Cercetări biologice și de combatere asupra omizii capsulelor de bumbac** (*Heliothis armigera* **Hb.).** [Research on the bionomics and control of the cotton bollworm (*H. armigera*).]—*Anal. Inst. Cerc. agron.* **26** (C) pp. 215–237, 10 figs., 68 refs. Bucharest, 1959. (With summaries in Russian & French.)

Heliothis armigera (Hb.) causes serious damage to cotton and other crops in Rumania, and its bionomics and control were investigated there in 1953–57. The adults emerged in spring at a mean day temperature of 16–17°C. [60·8–62·6°F.], and the fecundity of the females depended on the food-plant of the larvae from which they developed, those from larvae that had fed on chick-pea [*Cicer arietinum*] or lucerne resulting in females that laid 486–2,595 and 271–1,100 eggs, respectively. The eggs hatched in 3–5 days in the field, and the larvae fed for 13–15 days at a constant temperature of 28·5°C. [83·3°F.] and for 16–18 days at 26°C. [78·8°F.]. There was a prepupal period of 1·5–4 days, and the pupal stage lasted 14–15 days at 24·5°C. [76·1°F.] and 9–11 days at 28·5°C. The Noctuid passed through 2–3 generations a year and overwintered as a pupa in the soil. Experiments on the control of the first generation were carried out on chick-pea and of the second and third on cotton in each year [*cf. R.A.E.*, A **47** 190]. The most effective treatments were a spray of 0·75 per cent. wettable DDT against the first generation, a dust of 5 per cent. DDT mixed with 3 per cent. γ BHC and a 1·5 per cent. wettable DDT spray against the later ones, and a 5 per cent. DDT dust and a 0·5 per cent. DDT emulsion spray against all three. Two applications against the first and third generations and one or two against the second were necessary during heavy infestation, but one against the first and one or two against the third sufficed when the attack was less severe.

Hrisafi (C.), Ionescu (M.), Simionescu (L.) & Macrea (I.). **Cercetări asupra biologiei și combaterii gărgăriței florilor de trifoi** (*Apion apricans* **Herbst.).** [Studies on the bionomics and control of the clover weevil (*A. apricans*).]—*Anal. Inst. Cerc. agron.* **26** (C) pp. 239–252, 20 refs. Bucharest, 1959. (With summaries in Russian & French.)

Apion apricans Hbst. severely reduces the yield of clover seed in Rumania, and its bionomics and control were investigated in 1953–57. The adult weevils left their winter quarters at a mean daily temperature of 11–13°C. [51·8–55·4°F.], and pairing and oviposition began in late May. The larvae hatched in 5–10 days and, at a temperature of 16–23°C. [60·8–73·4°F.], they fed for 20–36 days, destroying 11–16 florets each per capitulum. There was one generation a year. In tests on control, the best results were given by 2–3 applications of dusts of 5 per cent. DDT, 1·5 and 0·8 per cent. γ BHC as lindane, or 3·5 per cent. DDT with 0·5 per cent. γ BHC, a wettable-powder spray of 0·2 per cent. DDT, and emulsion sprays of 0·7 per cent. γ BHC or DDT. Two applications more than trebled the yield, and a third did not significantly improve this result.

Lekić (M.). *Rhynchites* (*Coenorrhinus*) *germanicus* **Herbst štetočina jagoda kod nas.** [*R. germanicus*, **a pest of strawberries in Yugoslavia.**]—*Arh. poljopr. Nauke* **12** pt. 38 pp. 82–99, 9 figs., 16 refs. Belgrade, 1959. (With a summary in English.)

Damage by *Rhynchites germanicus* Hbst. was observed in Yugoslavia for the first time in 1956, when strawberries were injured near Belgrade.

The infestation spread in subsequent years, and observations on the bionomics and control of the weevil were made in 1957–59. The damage was due to the adults, which appeared in March and April and fed for up to a fortnight on the new leaves and flower shoots before reaching sexual maturity. Pairing occurred at temperatures as low as 15–17°C. [59–62·6°F.] and oviposition at 16–17°C. [60·8–62·6°F.], but both were most intense at 22–28°C. [71·6–82·4°F.]. Eggs were laid during the second half of April and the first half of May in punctures in the flower and leaf stalks. The sap flow was thereby cut, and the stalks withered above the punctures [*cf. R.A.E.*, A **37** 403]. The larvae hatched in five days at a temperature of 30°C. [86°F.] and in 15 days at 18°C. [64·4°F.] in the laboratory, and in 6–16 days in the field, all at a relative humidity of about 60 per cent. They fed on the dead parts of the stalks, became full-fed in 30–40 days and then moved into the soil, where they pupated 10–15 days later. The few larvae that did not pupate in autumn (2·3 per cent. of the total in 1958) did so in the following spring. The pupal stage lasted 14–18 days, and the sexually immature adults overwintered in the pupal chambers. Chemical control is best applied while the adults are feeding and ovipositing. Systemic and other organophosphorus insecticides proved highly toxic to them but were too dangerous to man and livestock, and BHC, though effective, tended to affect the odour of the fruit. A dust of 0·1 or 0·125 per cent. DDT gave complete protection. Normally one application at the beginning of the development of the flower shoots is sufficient, but two are recommended if infestation is heavy, particularly during wet weather, one before the development of the flower shoots and the other just before flowering.

Baggiolini (M.). **Les mineuses des arbres fruitiers en Suisse romande.**—*Rev. rom. Agric.* **15** no. 2 pp. 17–20, 8 figs., 5 refs. Lausanne, 1959.

Seven species of insects are noted as mining the leaves of fruit trees in French Switzerland, and information is given on the appearance of the mines, the bionomics of the species, and, for five of the six Lepidoptera, methods of control. The most injurious is *Lyonetia clerkella* (L.), which chiefly attacks apple and cherry.

Mathys (G.). **L'acariose ou court-noué parasitaire de la vigne** (*Phyllocoptes vitis* **Nal.**).—*Rev. rom. Agric.* **15** no. 2 pp. 21–23, 3 figs., 5 refs. Lausanne, 1959.

In view of the increased importance of *Phyllocoptes vitis* Nal. on vines in French Switzerland, notes are given on the bionomics and control of this Eriophyid, which was particularly numerous in 1958.

Mathys (G.) & Tencalla (Y.). **L'identification par les praticiens des principaux acariens nuisibles aux arbres fruitiers et à la vigne.**—*Rev. rom. Agric.* **15** no. 3 pp. 30–32, illus., 3 refs. Lausanne, 1959.

The author gives figures and notes in tabular form enabling growers to identify the principal phytophagous mites (excluding Eriophyids) and also the predacious mites that occur on fruit trees and vines in French Switzerland and the Ticino, with notes on chemical control.

Romanyk (N.). **Nueva plaga en los pinares de Guadarrama.** [A new pest in the pine forests of the Guadarrama.]—*Bol. Serv. Plagas for.* **1** no. 1 pp. 7–11, 2 col. pls., 3 figs. Madrid, 1958.

Ceballos (G.). **Una especie nueva de Ichneumonidae, parásito de** *Ocnerostoma piniariella.* [A new species of Ichneumonid parasitising *O. piniariella.*]—*T.c.* pp. 13–16, 3 figs., 1 ref.

In the first of these papers, notes are given on a small outbreak of *Ocnerostoma piniariella* Zell. on pine trees in the Guadarrama mountains, in Spain, and all stages of this Hyponomeutid are briefly described. Observations in 1957 showed that the eggs were laid in July–August near the tips of the needles; the larvae mined the needles, overwintering in the mines, but left them when full-fed and pupated on other needles. The adults emerged 2–3 weeks later, in early June. There was only one generation in the year. An Ichneumonid that emerged from many of the pupae is described in the second paper from the adult male as *Herpestomus neirae*, sp.n.

Romanyk (N.). **Los tratamientos y el parasitismo de** *L. dispar* **en los encinares de Salamanca.** [Treatments and the parasitism of *L. dispar* in the oak forests of Salamanca.]—*Bol. Serv. Plagas for.* **1** no. 1 pp. 27–32. Madrid, 1958.

An outbreak of *Lymantria dispar* (L.) began in oak forests near Salamanca in 1952 and reached its peak in 1957. A 10 per cent. DDT dust was applied from the ground and air to large areas in 1955, 1956 and 1957 and gave good control without affecting pupal parasites, which were numerous. The most important of the latter were *Brachymeria intermedia* (Nees) and *Monodontomerus aereus* Wlk.

Rupérez Cuéllar (A.). **Sugerencias sobre la lucha biológica contra la** *Lymantria dispar* **en estado de huevo.** [Suggestions on the biological control of *L. dispar* in the egg stage.]—*Bol. Serv. Plagas for.* **1** no. 1 pp. 41–53, 8 figs., 1 ref. Madrid, 1958.

Information is given on the methods adopted in Spain for rearing *Anastatus disparis* Ruschka and *Ooencyrtus kuvanae* (How.) in the eggs of *Lymantria dispar* (L.) for release against the latter, with particular reference to temperature effects.

Torrent (J. A.). **Tratamientos de la procesionaria del pino** (*Thaumetopoea pityocampa* **Schiff.).** [Treatment against the pine processionary, *T. pityocampa.*]—*Bol. Serv. Plagas for.* **1** no. 2 pp. 65–80, 8 figs., 1 ref. Madrid, 1958.

Thaumetopoea pityocampa (Schiff.) is widely distributed on species of pine in Spain, and defoliates the trees but does not kill them. It is best attacked in the larval stage, either by collection and burning of the nests or by dusts, mists or atomised sprays of DDT; atomised sprays of endrin are also effective.

Coaker (T. H.). **"Insack" treatment of maize with insecticide for protection against storage pests in Uganda.**—*E. Afr. agric. J.* **24** no. 4 pp. 244–250, 6 figs., 2 refs. Nairobi, 1959.

In Namulonge, Uganda, maize has to be harvested before it is dry. It is dried in sacks and shrinks in the process, so that the sacks are no longer

full, and the injection of an insecticide dust into the sack, followed by tumbling to distribute it through the grain, was tested as a method of protection against insects. A dust of γ BHC was injected by means of a pressure gun, and the grain subsequently observed for insect attack, in comparison with untreated maize and maize treated by the usual method of loose mixing. The results showed that insecticidal treatment was necessary and that the injection method was promising, for maize subsequently stored in bulk or in the sack, provided that good distribution was achieved. Maize treated with 0·5 per cent. γ BHC dust at 1–4 parts per million remained in good condition, with little insect damage, for ten months. The method was not so long-lasting in its effects as loose mixing, but is more practicable for large quantities of maize.

McKinlay (K. S.). **Toxicities of various acaricides to mites of the *Tetranychus* complex in East Africa.**—*E. Afr. agric. J.* **25** no. 1 pp. 28–30. Nairobi, 1959.

Cotton in Tanganyika is sometimes infested by mites of the complex of *Tetranychus telarius* (L.), and as parathion failed to control them in 1958, other materials were tested in the laboratory and field. The following is taken from the author's summary of the results. Methyl-demeton (Metasystox) appeared to be the most effective, but single applications of either this or dimethoate (Rogor) at 0·0125 per cent. as wetting sprays aimed at both leaf surfaces gave good field control. Neither material killed the eggs, but laboratory tests showed that they retained their toxicity long enough to kill mites hatching from eggs laid as recently as the day before spraying.

Ryke (P. A. J.) & Meyer (M. K. P.). **Spider mites and false spider mites with notes on South African species and the basic concepts regarding their biological control.**—*S. Afr. J. agric. Sci.* **1** no. 4 pp. 357–373, 10 figs., 67 refs. Pretoria, 1958. (With summaries in Afrikaans & French.)

A list is given of 14 species of Tetranychids, seven Phytoptipalpids and a Tuckerellid collected by the authors in South Africa, showing the plants on which they were taken and their local distribution. The most widely distributed were *Tetranychus telarius* (L.) and *Brevipalpus obovatus* Donn. (*inornatus* (Banks)), which occur in all parts of the Union and are recorded from over 40 and 12 species of plants, respectively, in addition to many unidentified grasses and weeds. The control of phytophagous mites is discussed, with special reference to predators, and it is stated that the most important of the latter in South Africa are mites of the genus *Typhlodromus*.

Geyer (J. W.). **The castor oil midge *Asphondylia ricini* Mani.**—*S. Afr. J. agric. Sci.* **1** no. 4 p. 465. Pretoria, 1958.

The staminate flower buds and pistillate flowers of castor (*Ricinus communis*) in the northern Transvaal, and also the berries of *Cissus* sp. growing nearby, were found in March 1958 to be infested by larvae of *Asphondylia ricini* Mani, which was described from India in 1947 [*R.A.E.*, A **36** 110] and has not previously been recorded from Africa. It is thought to have reduced the yield severely.

Ellis (P. E.). **Learning and social aggregation in locust hoppers.**—*Anim. Behav.* **7** no. 1–2 pp. 91–106, 7 figs., 22 refs. London, 1959.

The following is based on part of the author's summary. Locust hoppers reared in isolation (phase *solitaria*) are not attracted towards one another when first confined together, but, if forcibly crowded, they learn to aggregate socially within a few hours [*cf. R.A.E.*, A **43** 297]. The stimuli of importance during this process were studied in *Locusta migratoria migratorioides* (R. & F.) and *Schistocerca gregaria* (Forsk.). Single hoppers each reared with a crowd of nymphs of a non-gregarious grasshopper (*Eyprepocnemis*) or with woodlice (Isopods) aggregated socially when first placed together. When single hoppers were reared in transparent boxes placed in a cage full of other hoppers, so that direct contact with these was eliminated, but visual, auditory and olfactory stimuli were received from them [*cf.* **31** 522], social aggregation was increased a little in *Locusta*, but not at all in *Schistocerca*. Previously isolated hoppers showed increased grouping after being crowded with other hoppers for only seven hours in either the dark or the light. Social aggregation was also increased in hoppers that were reared in isolation but were touched by fine wires suspended from a revolving frame during a seven-hour training period before being tested; they grouped almost as well as hoppers that had been crowded with other locusts.

The behaviour patterns shown by crowded and by previously isolated hoppers when they first meet others are described. Both examined objects, including other locusts, with the antennae and palps, but, when touched themselves, previously isolated hoppers moved away, whereas crowded ones remained where they were and kicked with their hind legs or twirled the antennae. During the process of learning, previously isolated hoppers appear first to become habituated to being touched. This is followed, after further contacts, by hind-leg kicking and antenna twirling, which probably play a positive part in keeping the hoppers together in groups. The complete process could be brought about by touching isolated hoppers repeatedly with the fine wires before they were put with other locusts. Nymphs of *Eyprepocnemis* did not aggregate socially even when reared in crowds. Records of colour changes were kept during the experiments. The coloration typical of phase *gregaria* appeared to depend on a complex of stimuli between hoppers, through the auditory, visual, olfactory and tactile sense organs. On the whole, the two species of locusts gave similar results, but the process of learning was a little more rapid in *Schistocerca* than in *Locusta*.

Papers noticed by Title only.

Friend (W. G.), Salkeld (E. H.) & McClanahan (R. J.). **A chemically defined diet and axenic rearing method for larvae of the seed-corn maggot,** *Hylemya cilicrura* **(Rond.) (Diptera: Anthomyiidae).**—*Canad. J. Zool.* **36** no. 6 pp. 931–936, 7 refs. Ottawa, 1958.

Davis (G. R. F.). **A method for rearing larvae of** *Ctenicera aeripennis destructor* **(Brown) (Coleoptera: Elateridae) aseptically in test tubes.**—*Ann. ent. Soc. Amer.* **52** no. 2 pp. 173–175, 2 figs., 11 refs. Washington, D.C., 1959.

Tjoa Tjien Mo. *Bedellia annuligera* **Meyr. (Lep., Bedelliidae), hama baru jang penting pada ubi djalar didaerah Lembang (Bandung).** [*B. annuligera*, a new insect pest of sweet potatoes in Lembang (Bandung, West Java).]—*Contr. gen. agric. Res. Sta. Bogor* no. 153, [1+] 11 pp., 11 figs., 3 refs. Bogor, 1959. (With a summary in English.)

Lionnet (J. F. G.). **A review of the biological control of agricultural pests in the Seychelles.**—*E. Afr. agric. J.* **24** no. 4 pp. 254–256, 7 refs. Nairobi, 1959.

THE INSECT PESTS OF COTTON IN TROPICAL AFRICA

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